Sediment Characterization Report in Support of the Feasibility Study

for

Site 17 - Pettibone Creek

Naval Station Great Lakes
Great Lakes, Illinois

Naval Facilities Engineering Command
Midwest

Contract Number N62467-04-D-0055

Contract Task Order 474

July 2012

FINAL
SEDIMENT CHARACTERIZATION REPORT IN SUPPORT OF THE FEASIBILITY STUDY FOR SITE 17 – PETTIBONE CREEK

NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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ACRONYMS AND ABBREVIATIONS

bss	Below sediment surface
cm	Centimeter
COC	Chemical of Concern
CTO	Contract Task Order
DUA	Data usability assessment
Empirical	Empirical Laboratories, LLC
EPA	Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera
HHRA	Human health risk assessment
IAW	In accordance with
MBI	Modified Biotic Index
mg/kg	Milligram per kilogram
mIBI	Macroinvertebrate Index of Biotic Integrity
msl	Mean sea level
NA	Not applicable/Not available
NAVFAC	Naval Facilities Engineering Command
Navy	U. S. Department of the Navy
NCRS	North Chicago Refiners and Smelters
NFA	No further action
NOECs	No Observed Effects Concentrations
NSGL	Naval Station Great Lakes
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PEC	probable effects concentration
PSL	Project screening level
QHEI	Qualitative Habitat Evaluation Index
RA	Risk Assessment
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SOP	Standard operating procedure
TOC	Total organic carbon
U.S.	United States
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This Sediment Characterization Report in Support of the Feasibility Study for Site 17 – Pettibone Creek at the Naval Station Great Lakes (NSGL), Great Lakes, Illinois presents the results of the March 2012 sampling event.

Site 17 – Pettibone Creek, located at NSGL in Great Lakes, Illinois, comprises Pettibone Creek (North and South Branches) and the Boat Basin. For the investigation, "the Site" was defined as the portion of the North Branch of Pettibone Creek that lies within the NSGL property boundary, exclusive of the Boat Basin. The South Branch of Pettibone Creek is considered the "Reference" area. A variety of land uses currently surround NSGL, including urbanized and industrial areas to the north, industrial use areas to the west, and a mixture of public use land and residential neighborhoods to the south. Former industries located upstream of NSGL were turn-of-the-20th century manufacturing facilities that produced tantalum mill products, non-ferrous metals, and zinc oxide. Discharges from these industries, in combination with discharges from several storm sewers which collect water/runoff from a large section of the City of North Chicago, have contributed to elevated concentrations of contaminants in Pettibone Creek and Boat Basin sediments. Because of the industrial and urban nature of this watershed, Pettibone Creek is subject to flash flooding and associated erosive forces during storm events; therefore, the sediment present is mobile. The creek bottom sediment which erodes during storm events is believed to deposit in layers in the Boat Basin, based on layering observed during previous Boat Basin investigations.

Previous investigations detected elevated concentrations of several chemicals in the most upstream samples in Pettibone Creek, indicating that the predominant source of these chemicals appears to be off-site of NSGL; therefore, not all of the identified chemical contamination is site related. Human health and ecological risk assessments were performed as part of previous investigations to determine risk to representative receptors that have the potential to be exposed to site-related contamination. The human health risks were acceptable. The ecological risk assessment indicated potential risks to benthic invertebrates exposed to contaminated sediments.

Because of the potential ecological risks, the Navy conducted this investigation to determine: whether benthic invertebrates are adversely impacted from exposure to North Branch Pettibone Creek sediment; the current sediment quality in Pettibone Creek; and whether a continuing source of sediment contamination persists upstream of Navy property.

The sampling event consisted of collecting the following samples:

- Benthic invertebrates to assess benthic community health.
- Surficial sediment to determine sediment quality and toxicity, and to determine whether an upstream continuing source of contamination is present.
- Suspended sediment to determine whether an upstream continuing source of contamination is present. The samplers were deployed in March and were collected in June 2012.

When site and reference sample benthic invertebrate metrics are compared to chemical concentrations, there is no correlation between the sediment chemical concentrations and the benthic community health. Three lines of evidence were used to determine whether the benthic community was being impacted in Pettibone Creek, and if so, whether the impacts were related to the chemicals in the sediment. The first line of evidence, the benthic community survey, found that the benthic community in Pettibone Creek ranged from poor to fair; however, samples were collected outside of the index period specified by Illinois Environmental Protection Agency (EPA) for the use of these rankings. Although in general, the benthic communities in the reference reaches (South Branch) were better than those in the site reaches (North Branch). There was a strong correlation between the benthic community health and the habitat conditions. The next line of evidence was sediment chemistry. Several chemicals were detected at concentrations that exceeded their respective ecological screening levels. Among these chemicals, copper, lead, zinc, and total PAHs have the highest probability of impacting sediment invertebrates. Finally, the last line of evidence, toxicity testing, found that none of the site samples were considered impacted regarding the survival or growth of *Hyalella azteca.* Based on the results of these three lines of evidence, it does not appear that the chemicals in the sediment are impacting the benthic community in Pettibone Creek to a significant degree. The lack of toxicity observed in the toxicity test supports the likelihood that the poor to fair benthic community in the creek is related to the habitat. This is further supported by the plots that were prepared to evaluate the relationship between chemical concentrations and benthic community of the toxicity test results. No strong relationships were found on these plots.

Maximum concentrations of metals and PCBs were generally detected in the furthest upstream sampling location. Although the elevated metal concentrations are likely reflective of the manufacturing facilities that existed in this area, it is not known whether the concentrations in the sediment represent historical discharges, or whether there are current sources of metals that are still discharging to Pettibone Creek. A suspended sediment sample collected from culverts that receive stormwater drainage from the former manufacturing facilities area and northern part of NSGL had higher metals concentrations compared to all site and reference samples. The suspended sediment results suggest that upstream sources are continuing to contribute to the chemical concentrations detected in Pettibone Creek downstream of where the creek enters the NSGL property. Maximum concentrations of PAHs were detected in an upstream sampling location which is immediately downstream of a storm sewer collecting water/runoff from a large section of the City of North Chicago. It is likely that upstream sources are continuing to contribute to the elevated PAHs concentrations detected in Pettibone Creek downstream of where the creek enters the NSGL property.

Based on the results of this investigation, no actions are recommended for Pettibone Creek because the poor benthic communities in some of the North Branch samples are likely related to the habitat, and not the sediment chemistry. Also, there appears to still be current sources of contamination to Pettibone Creek. However, one relatively simple step that could be taken to improve habitat conditions and channel morphology would be to refrain from removing woody debris that falls into the stream channel and along the banks. The woody debris also increases habitat complexity and provides stable, inhabitable substrate for specialized macroinvertebrates, including serving as a nutritional source for some. In any case, goals for restoration should be coordinated and measures to gage project success should be established as restoration activities are planned.

1.0 INTRODUCTION

This Sediment Characterization Report in Support of the Feasibility Study for Site 17 – Pettibone Creek at the Naval Station Great Lakes (NSGL), Great Lakes, Illinois was prepared for the United States (U.S.) Department of Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Midwest by Tetra Tech under the Comprehensive Long-Term Environmental Action Navy, Contract Number N62467-04-D-0055, Contract Task Order (CTO) 474.

1.1 PURPOSE AND SCOPE

The purpose of this Sediment Characterization Report is to present the results of the most recent sampling conducted in accordance with the Sampling and Analysis Plan (SAP) (Tetra Tech, 2012), and to determine the following:

- Whether benthic invertebrates are adversely impacted from exposure to North Branch Pettibone Creek sediment.
- Current sediment quality in North Branch and South Branch of Pettibone Creek.
- Whether a continuing source of sediment contamination persists upstream of Navy property.

The most recent sampling event was conducted in March 2012 and consisted of collecting the following samples:

- Benthic invertebrates to assess benthic community health.
- Surficial sediment to determine sediment quality and toxicity, and to determine whether an upstream continuing source of contamination is present.
- Suspended sediment to determine whether an upstream continuing source of contamination is present. The samplers were deployed in March 2012 and were collected in June 2012.

The three lines of evidence collected as part of this investigation (sediment chemistry, sediment toxicity, and benthic community data) were used to determine whether the benthic community is being impacted and whether those impacts (if observed) are related to the chemicals in the sediment. The three lines of evidence were evaluated in accordance with the decision rules presented in the flow chart on Figure 5-1 of the SAP, which is included in this report as Figure 1-1.

1.2 REPORT ORGANIZATION

This Sediment Characterization Report is divided into the following sections:

- Section 1.0, Introduction, provides background information including the location and description of Site 17 – Pettibone Creek and a summary of previous investigations.

- Section 2.0, Sampling Investigation, describes the March 2012 sampling event and any deviations from the SAP.

- Section 3.0, Evaluation of Analytical Results, presents the results of March 2012 sampling event and evaluates data based on decision rules presented in the SAP.

- Section 4.0, Summary, Conclusions, and Recommendations.

1.3 SITE BACKGROUND

Site 17 – Pettibone Creek is located at NSGL in Great Lakes, Illinois. Site 17 comprises Pettibone Creek (North and South Branches) and the Boat Basin (see Figure 1-2). The North Branch of Pettibone Creek originates in North Chicago, enters the northwestern corner of NSGL, and flows south and east through the Mainside of the Naval Station until it enters the Boat Basin and discharges into Lake Michigan along the western shoreline. The North Branch of Pettibone Creek has a tributary which enters from the west about 900 to 1000 feet south from where the North Branch enters NSGL. The South Branch of Pettibone Creek originates in a residential area southwest of the Naval Station, flowing northward through a golf course and the Mainside of the Naval Station. The South Branch of Pettibone Creek is considered to represent a typical residential area unaffected by NSGL operational activities. The South Branch of Pettibone Creek has a tributary which enters from the west about 1000 feet south of the point where the North and South Branches of Pettibone Creek join. The North and South Branches of Pettibone Creek join approximately 1,500 feet west of Lake Michigan. For the investigation, “the Site” was defined as the portion of the North Branch of Pettibone Creek that lies within the NSGL property boundary, exclusive of the Boat Basin. The South Branch of Pettibone Creek is considered the “Reference” area.

Pettibone Creek is located in a stream valley with steeply eroded slopes. Pettibone Creek and its tributaries flow within a ravine that divides the plateau where the majority of NSGL activities occur, and then discharge to the Boat Basin. Elevations vary from approximately 650 feet above mean sea level (msl) at the top of the Pettibone Creek hillsides, to approximately 577 feet above msl at the Boat Basin, where the Pettibone Creek discharges to Lake Michigan (Tetra Tech NUS, Inc., 2003a). Pettibone Creek ranges between 15 and 30 feet in width, and several inches to 2 feet in depth.

A variety of land uses currently surround NSGL, including urbanized and industrial areas to the north, industrial use areas to the west, and a mixture of public use land and residential neighborhoods to the south. Former industries located upstream of NSGL include the North Chicago Refiners and Smelters (NCRS), the Vacant Lot, and Fansteel. These facilities were turn-of-the-20th century manufacturing facilities that produced tantalum mill products, non-ferrous metals, and zinc oxide. Discharges from these industries, in combination with discharges from several storm sewers which collect water/runoff from a large section of the City of North Chicago, have contributed to elevated concentrations of contaminants in Pettibone Creek and Boat Basin sediments. A Watershed Contaminated Source document (Tetra Tech NUS, Inc., 2003b) summarizes the activities that may have had an impact on sediments in Pettibone Creek and the Boat Basin.

Storm sewers that collect stormwater from a large section of the City of North Chicago drain to the creek upstream of Navy property [Illinois Environmental Protection Agency (EPA), 1995], and 30 NSGL stormwater sewer system outfalls from roadway drainage systems drain to the creek from the Navy property (Halliburton NUS, Inc., 1993). Because of the industrial and urban nature of this watershed, Pettibone Creek is subject to flash flooding and associated erosive forces during storm events; therefore, the sediment present is mobile. The creek bottom sediment which erodes during storm events is believed to deposit in layers in the Boat Basin, based on layering observed during previous Boat Basin investigations.

Fish are present in the creek and fish have been observed migrating upstream in the spring (Illinois EPA, 1995) and fall. No federally listed endangered or threatened species are known to exist in the area. The Mudpuppy salamander is listed as a threatened species that is protected by the State of Illinois. NSGL is conducting a study with the secondary objective to determine whether the Mudpuppy salamander is present in Pettibone Creek and the Harbor at NSGL, along with some additional locations. One sampling event was conducted in July 2011, but no Mudpuppy salamanders were observed or captured in the area during this event. Two additional sampling events occurred in 2012 but the results are not yet available. Habitat suitable to threatened or endangered species does not exist in Pettibone Creek, at least in part because of the highly developed nature of the surrounding land (U.S. Navy, 2010).

1.4 PREVIOUS INVESTIGATIONS

The following environmental investigations have been conducted at Site 17:

- Illinois EPA and USEPA investigations of sediment in the 1970s and 1980s.
- Initial Assessment Study at Naval Station Great Lakes (Rogers, Golden, & Halpern and BCM Eastern Inc., 1986).
- Site Inspection Report for Pettibone Creek, Boat Basin, and Harbor Area (Halliburton NUS, 1993).
- Comprehensive Environmental Response, Compensation, and Liability Act Expanded Site Inspection Report (Illinois EPA, 1995).
- Remedial Investigation and Risk Assessment Report - Site 17 – Pettibone Creek and Boat Basin (Tetra Tech NUS, Inc., 2003a).
- Feasibility Study for Site 17 Pettibone Creek and Boat Basin (Tetra Tech NUS, Inc., 2005).

In addition, abandoned industrial facilities in the City of North Chicago, located along the North Branch of Pettibone Creek upstream of NSGL, were included in investigations by the USEPA and Illinois EPA. Details of the previous investigations listed above are provided in the Remedial Investigation/Risk Assessment (RI/RA) Report (Tetra Tech NUS, Inc., 2003a), and Feasibility Study (Tetra Tech NUS, Inc., 2005). An additional field investigation conducted in December 2008 is documented in the draft Remedial Action Plan (Tetra Tech NUS, Inc., 2011).

Pettibone Creek is susceptible to flash floods characterized by high channel velocities with great erosive potential. Because of the transient nature of sediment and the amount of time that has passed since the last sediment data collection, the current extent of contamination, if any, is unknown. Over time, the sediment contaminant concentrations may have decreased and been redistributed along the North Branch of Pettibone Creek. Continued washout of sediments upstream of Navy property is considered to be a potential continuing source of sediment contamination on Navy property.

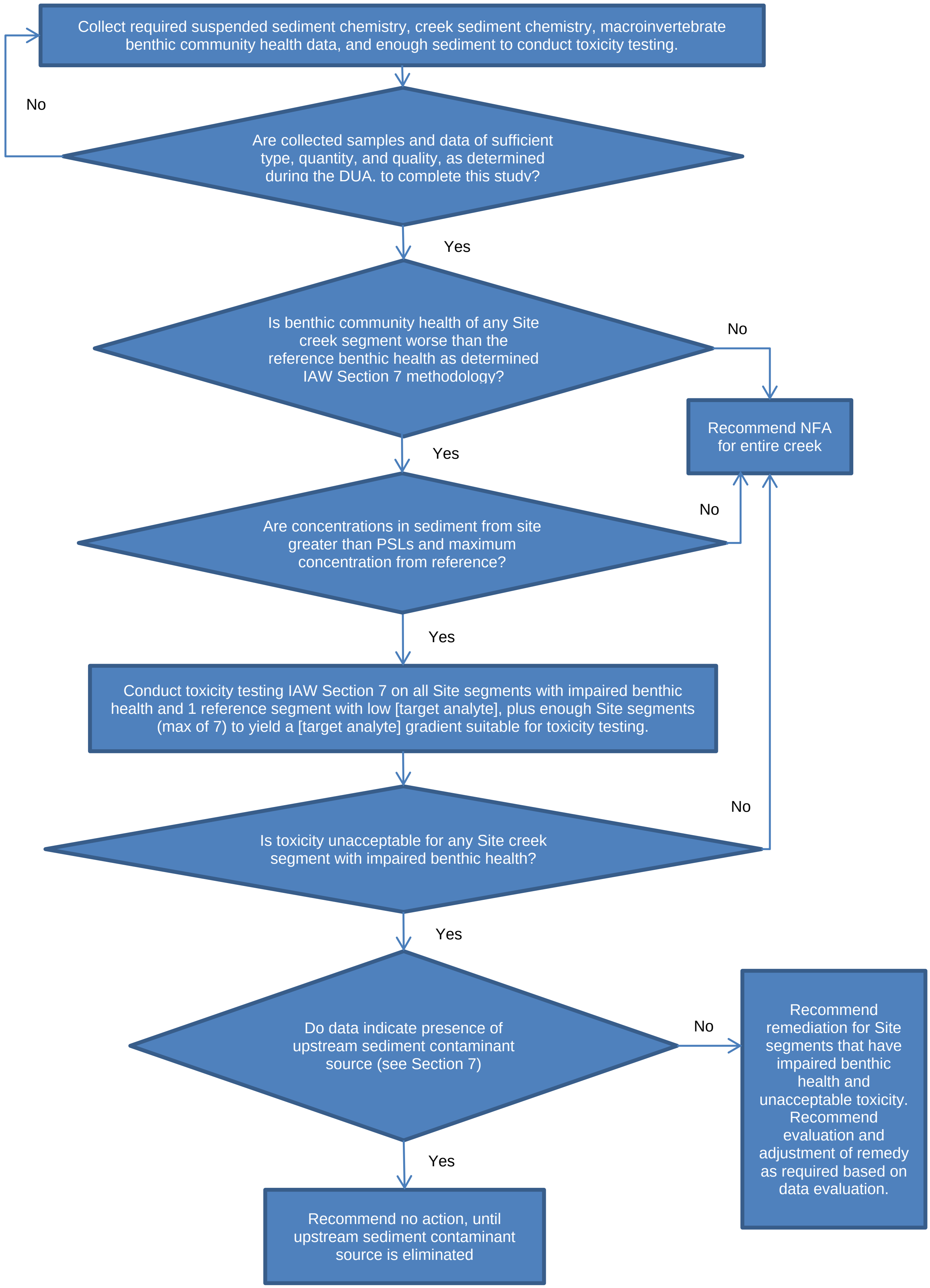
Based upon previous investigations, volatile organic compounds were not significant site-related contaminants at Site 17. Previous investigations identified an increase in polynuclear aromatic hydrocarbon (PAH) concentrations in sediment samples, which is believed to have been caused by the widespread use of petroleum products in modern industrialized society. Previous polychlorinated biphenyl (PCB) concentration patterns that indicated greater PCB concentrations near the upstream edge of NSGL property suggest that upstream chemical sources may have contributed to the sediment contamination. In addition, PCB contamination of sediments may have occurred as a result of the storage of out-of-service transformers (some filled with PCB-containing oil) at various locations within the Naval Station. Predominant inorganic metals (such as copper, lead, and zinc) found in Site 17 sediments were identified as significant environmental contaminants in sediment samples collected upstream of Site 17. The RI/RA (Tetra Tech NUS, Inc., 2003a) indicated that concentrations of target analytes detected in offsite upstream samples were often two to three times greater than concentrations in Site 17 sediment samples. Elevated concentrations of several chemicals in the most upstream samples indicate that the predominant source of these chemicals appears to be offsite of NSGL; therefore, the chemicals may not be site related.

Previously collected data show that creek bottom sediments are stratified with respect to contaminant levels. A blue-gray clay layer located about 1 foot below the sediment surface (bss) is considered to represent native material that is not contaminated. Benthic organisms generally occupy the top 4 centimeters (cm) of sediment, and this is generally observed to be the most contaminated layer.

Human health and ecological risk assessments were conducted during the RI/RA using data from the 2001 field investigation (Tetra Tech NUS, Inc., 2003a) for representative receptors that have the potential to be exposed to site-related contamination.

The human health risk assessment (HHRA) focused on adolescent and adult recreational users exposed to surface water, sediment, and fish in Pettibone Creek and Boat Basin. The human health risks associated with exposure to chemicals of potential concern in sediment and surface water from Pettibone Creek for both the adult and adolescent recreational users were either less than or within USEPA target levels. Although some fish may be present in the North Branch of Pettibone Creek, it does not support a significant fish population; therefore, the HHRA assumed that recreational fishing does not occur within Pettibone Creek. However, the HHRA did consider human health risk from ingestion of fish caught in the Boat Basin. Fish tissue samples were not collected; instead, fish tissue concentrations were estimated from sediment concentrations and sediment bioaccumulation factors. Fish ingestion risks for recreational fishermen (based on the estimated fish tissue contaminant concentrations) exceeded USEPA target levels for PCBs and pesticides; the risks to recreational fishermen were consistent with the Illinois EPA fish advisories for Lake Michigan.

A screening-level ecological risk assessment was performed using surface water and sediment data. No chemicals detected in surface water were retained as chemicals of concern (COCs) for potential risks to aquatic organisms. PAHs, several pesticides, and several metals were retained as COCs for potential risks to benthic invertebrates exposed to contaminated sediments. Two pesticides (4,4'-DDE and 4,4'-DDT) were retained as COCs for potential risks to piscivorous birds exposed to contaminated sediments via ingestion of fish and benthic invertebrates. However, wildlife is not expected to be impacted because the limited populations of fish in the creek will only account for a small portion of their diet from the site. Soil erosion in the creek may add physical stressors to the risks to benthic invertebrates.



DUA = Data usability assessment
IAW = in accordance with
NFA = No Further Action
PSL = Project Screening Level

Figure 1-1 Flow Chart of DQO Decision Rules

PGH P:\GIS\GREATLAKES_NS\MAPDOCS\MXD\SITE17_VICINITY_MAP.MXD 03/01/12 SP

DRAWN BY J. ENGLISH	DATE 12/19/11	SITE VICINITY MAP SITE 17 - PETTIBONE CREEK RAP NAVAL STATION GREAT LAKES GREAT LAKES, ILLINOIS	CONTRACT NUMBER 1021 / CTO NUMBER 474
CHECKED BY L. GANSER	DATE 03/01/12		APPROVED BY ___ / DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ / DATE ___
SCALE AS NOTED		NAVFAC	FIGURE NO. FIGURE 1-2 / REV 0

2.0 SAMPLING INVESTIGATION

This section provides a summary of the sampling activities conducted at Site 17 – Pettibone Creek during the March 2012 Sediment Characterization. Samples were collected in accordance with the SAP. Supporting documents for the field activities are provided in Appendix A, including the chain of custody forms and the sediment sample log sheets. Appendix B contains the field data sheets for the benthic invertebrate community study.

2.1 SAMPLING PROGRAM

The following summarizes the samples collected during this investigation. More detailed descriptions of sample collection are provided in Sections 2.1.1 through 2.1.4. Table 2-1 presents the samples that were collected as part of the current investigation. Figure 2-1 shows the sampling locations.

Sediment samples for chemical analysis and toxicity testing, and benthic community health data were collected to determine whether benthic invertebrates are being adversely impacted from exposure to North Branch Pettibone Creek sediment. Benthic invertebrates were collected from North and South Branches of Pettibone Creek to assess benthic community health throughout the creek. Surficial sediment samples were collected from North and South Branches (including the North Branch upstream of the NSGL property) to determine sediment quality throughout the creek, and to determine whether chemical concentrations in the North Branch sediment were elevated compared to concentrations in upstream and reference samples. Surficial sediment samples were also collected in the North Branch of Pettibone upstream of the NSGL property. Suspended sediment samples were collected from sediment traps installed at the culvert pipes at the North Branch northern entry point onto NSGL property. The upstream surficial sediment samples and suspended sediment samples were collected to determine whether there is a continuing source of sediment contamination to Pettibone Creek. The surficial and suspended sediment samples were analyzed for PAHs, select pesticides, PCBs, and select metals based on the COCs identified for sediments in the RI. Toxicity testing was conducted on select sediment samples to determine whether the sediment was toxic to sediment invertebrates.

Composite samples were collected for the benthic invertebrate surveys and surficial sediment analysis. Each sample location where benthic invertebrate survey and surficial sediment samples were collected consisted of a 300-foot long creek reach. When only a surficial sediment sample was collected, sample reaches were approximately 100 feet long. Sample locations were determined in the field using the midpoint coordinate for each 300 foot reach (see Table 2-1) and then measuring upstream and downstream to obtain the linear length of each reach. The length of the 100 foot sample reaches were determined visually based on physical features identified on a site aerial photograph (Figure 2-1).

The South Branch of Pettibone Creek was used as the reference area and was assumed to represent site conditions in the absence of upstream or site-related contamination.

2.1.1 Benthic Invertebrate Sample Collection

Benthic invertebrates were collected from 14 reaches to adequately characterize the benthic community present within Pettibone Creek (see Figure 2-1). Nine of these reaches represent the site and were located along the North Branch of Pettibone Creek (including one in the tributary), and five are reference reaches (including one in the tributary), located in the South Branch of Pettibone Creek.

Each of the sample locations consisted of a 300-foot long creek reach. The reaches were selected through mapping exercises to be regularly distributed reaches throughout the North and South Branches of Pettibone Creek; in areas where there was sufficient width of the wetted stream or tributary; and in avoidance of bridges and other major habitat alterations (if possible), and uncommon habitat features.

Standard Operating Procedures (SOPs) used by the Illinois EPA were followed for the field benthic macroinvertebrate sampling as indicated in the SAP (Tetra Tech, 2012). Site location and benthic sampling field forms are provided in Appendix B.

Field sampling methods included using a long handled D-frame net to produce a multi-habitat composite sample (a 20-jab sampling technique), targeting habitat types in proportion to their occurrence in the reach as described in the Illinois EPA SOP (Illinois EPA, 2011), and Appendix A of the SAP (Tetra Tech, 2012). It was assumed that the habitat types at the site and reference areas are comparable and fairly homogenous. Habitats that did not appear comparable and fairly homogenous (i.e., habitat types that made up less than 5 percent of the stream reach or were present only in the reference area and not the impact area) were not sampled.

In addition to collecting the benthic samples, the field crew made field observations related to stream habitat conditions, and conducted a visual-based physical habitat assessment and a modified 100-particle Wolman pebble count at each sample location. The modified 100-particle Wolman pebble count was conducted by dividing the sampling location into 10 transects based upon the percentage of features present within the stream reach (e.g., pools, riffles). Ten particles were randomly picked from the substrate at even intervals across each transect and measured with a sand gauge. Particles were determined to be either silt, very fine sand, fine sand, medium sand, coarse sand or very coarse sand. Particles larger than coarse sand were measured on a millimeter scale. The field forms for the habitat assessment and the pebble count completed in the field are presented in Appendix B. The habitat assessment includes measures of the Qualitative Habitat Evaluation Index (QHEI) as recommended by

Illinois EPA, and the Wolman pebble count for quantitative measurement of substrate particle size. Select field water quality parameters such as conductivity, dissolved oxygen, pH, and water temperature were measured in the field with a water quality meter and the results are presented in Table 2-2.

After the benthic samples were collected, they were processed in the field, which included sieving the sediment through a 500 micron sieve, preserving the retained material in 95 percent ethanol, and placing it in sample jars. The benthic samples remained in 95 percent ethanol for at least 14 hours. Prior to packaging and shipping the samples to the taxonomic laboratory, alcohol preservative was decanted from the sample jars to comply with Department of Transportation shipping requirements. The sample jars were placed into appropriate shipping containers and shipped to the taxonomic laboratory (Aquatic Resources Center, Inc., Nashville, Tennessee).

2.1.2 Surficial Sediment Sample Collection

Surficial sediment samples were collected from 20 reaches in Pettibone Creek to adequately characterize the sediment quality within the creek (see Figure 2-1). Twelve of these reaches represent the site and were located along the North Branch of Pettibone Creek (including two in the tributary) within the NSGL boundary; five are reference reaches (including one in the tributary), located in the South Branch of Pettibone Creek; and three are upstream reaches in the North Branch of Pettibone Creek, located prior to where the creek enters the NSGL property.

The sediment samples were collected from 0 to 4 cm bss using disposable plastic trowels in accordance with Tetra Tech SOP SA-1.2. At all 20 reaches, sediment samples were collected for chemical analysis. In addition, approximately 1 gallon of sediment was collected for toxicity testing from the 14 sample reaches where the benthic macroinvertebrate survey was performed; however, toxicity testing was actually only conducted on sediment from eight of these reaches (see Section 2.3). Sediment was collected from between ten to twelve locations within each reach (approximately half the number of benthic sampling locations using the jab technique), and placed into a 5-gallon plastic bucket lined with a plastic bag to obtain one composite sample for each reach. After the needed volume of sediment was obtained for a reach, the sample material was homogenized by manual mixing, and then placed into the appropriate sample bottles using a disposable trowel. The sample jars were placed into appropriate shipping containers and shipped to Empirical Laboratories, LLC (Empirical), Nashville, Tennessee for chemical analysis.

2.1.3 Suspended Sediment Sample Collection

Sediment traps were installed on March 27, 2012 in the culverts that discharge the North Branch of Pettibone Creek onto NSGL, and were deployed for 79 days to obtain a representative sample of upstream suspended sediment in the creek as it enters the NSGL property. Each trap is constructed from a 4-inch polyvinyl chloride pipe and a 7-inch by 32-inch filter bag, and is designed/installed in such a way as to collect and direct a portion of the stormwater discharge into the filter bag. The filter bag has a pore size of 1 micron to trap fine silt/clay (size less than 0.003 inches) suspended solids from the stormwater discharge. A screen/diverter on the inlet end of the trap minimizes trash, leaves, etc. from entering the trap. Photos of the sediment traps are included in Appendix A.

Sediment from the filter bags within the traps were collected on June 14, 2012 after being deployed 79 days and out of position approximately 3 days. The filter bags were removed from the sediment traps and placed in labeled plastic resealable bags. Suspended sediment from NTC17PCSD50 and NTC17PCSD51 were combined and placed in one resealable bag into order to provide sufficient sediment for analysis. The resealable bags were placed into appropriate shipping containers and shipped to Empirical, Nashville, Tennessee for chemical analysis. The sediment traps were removed and disposed of following sample collection.

After the samplers were first deployed, a storm event caused debris to gather on the upstream side of the traps and the water pressure turned the traps vertically so they were no longer collecting sediment. The traps were found out of position on April 30th. The debris was removed and the traps were repositioned three days later on May 3rd.

2.1.4 <u>Field Quality Control Sample Collection</u>

A summary of the quality control samples collected (i.e., equipment rinsate blanks and field duplicates) is presented in Table 2-3.

Disposable equipment was used; therefore, only one sample per batch of disposable equipment was collected. An equipment rinsate blank was collected from the plastic trowel and was analyzed for PAHs, select pesticides, PCBs, and select metals. Two field duplicates were collected for surficial sediment.

2.2 FIELD DOCUMENTATION

Documentation of field observations was recorded on sample log sheets. Field sample log sheets were used to document sample collection details, and other observations. Copies of the sample log sheets are provided in Appendix A.

2.3 ANALYTICAL PROGRAM

The taxonomic laboratory (Aquatic Resources Center, Inc. in Nashville, Tennessee) identified the benthic macroinvertebrates collected in accordance with the methods identified in the SAP (Tetra Tech, 2012). Two quality control steps were used to calculate quality control performance measures, such as taxonomic precision and percent sorting efficiency. These quality control steps included re-identification of select samples by Freshwater Benthic Services, Inc. in Petoskey, Michigan and re-sort to check for missed organisms by Tetra Tech's Center for Ecological Sciences in Owings Mills, Maryland. The results of the benthic invertebrate survey are presented in Section 3.0.

The analytical laboratory (Empirical) analyzed the surficial sediment samples in accordance with the analytical methods identified in the SAP (Tetra Tech, 2012). Empirical met the Project Action Limits identified in the SAP (Tetra Tech, 2012). Sediment sample results reported by the laboratory are presented in Section 3.0. Data validation reports are presented in Appendix C.

A data usability assessment (DUA) was completed in accordance with the SAP to make sure that the amount, type, and quality of data are sufficient to achieve project objectives. The DUA report is presented in Appendix C. In summary, the DUA found that the data adequately represent site conditions and the amount, type, and quality of data collected are sufficient to achieve the objectives of this sediment characterization report.

Physical sediment data, such as total organic carbon (TOC), and pH, were collected to help describe habitat conditions and assist in understanding the spatial distribution and magnitude of contamination. Although it was specified in the SAP, the sediment samples were inadvertently not analyzed for grain size due to an oversight during the sampling event. However, the absence of the data did not impact the results of the investigation because the pebble count conducted as part of the benthic invertebrate study was adequate to characterize the sediment substrate. The grain size data collected in 2001 during the RI are presented in Table 2-4. The sediment samples from 0 to 4 cm and from 1 foot below the sediment surface (bss) were classified as sand or silty sand. One sample was collected from 4 cm to 3 feet bss and was classified as clayey sand, which is consistent with the observation of a blue-gray clay layer located about 1 foot bss and is considered to represent native material.

As presented in Section 2.1.2, sediment was collected for toxicity testing from the 14 sample reaches where the benthic macroinvertebrate survey was conducted to determine whether the sediment was toxic to benthic invertebrates. Of the 14 sample reaches, samples from 6 of the site reaches (NTC17PCSD53, NTC17PCSD54, NTC17PCSD60, NTC17PCSD61, NTC17PCSD63, and NTC17PCSD64) and 2 reference reaches (NTC17PCSD66 and NTC17PCSD68) were selected for toxicity testing. These reaches were selected for toxicity testing based primarily on the results of the PAH and metals (specifically copper, lead, and zinc) analysis conducted on the surficial sediment samples from these reaches. The samples selected for toxicity testing represent a concentration gradient from low to high from the analysis results. Appendix D presents a memorandum describing sample selection with supporting tables and figures. 10-Day sediment toxicity tests were performed in accordance with the methods identified in the SAP (Tetra Tech, 2012), and the endpoints of the test were survival and growth. Toxicity testing was conducted because preliminary analysis of the benthic invertebrate survey indicated unacceptable benthic community health at some sampling locations, and chemical concentrations in several site sediment samples were greater than ecological sediment screening levels and the maximum concentration from reference locations. Toxicity testing was conducted by Tetra Tech's Center for Ecological Sciences in Owings Mills, Maryland.

TABLE 2-1

ANALYTICAL SUMMARY
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Sample Location	Coordinates[1]		Samples Collected/Analyzed			
	Easting	Northing	Benthic Invertebrates	Surficial Sediment	Suspended Sediment	Toxicity Testing
Suspended Sediment						
NTC17PCSD50	1116804.64	2057272.74			X*	
NTC17PCSD51	1116804.64	2057272.74				
NTC17PCSD52	1116804.64	2057272.74			X	
Site Locations						
NTC17PCSD53	1116928.8243	2057183.8898	X	X[2]		X
NTC17PCSD53 (Duplicate)	1116928.8243	2057183.8898		X[2]		
NTC17PCSD54	1116993.1179	2056881.3082	X	X		X
NTC17PCSD55	1117017.2582	2056515.8307		X		
NTC17PCSD56	1117034.8173	2056628.7196		X		
NTC17PCSD57	1116645.0522	2056521.4880		X		
NTC17PCSD58	1116857.5481	2056552.5316	X	X[2]		
NTC17PCSD59	1117056.3886	2056309.2813	X	X[2]		
NTC17PCSD60	1117326.9744	2056111.2843	X	X		X
NTC17PCSD61	1117535.0762	2055861.8317	X	X[2]		X
NTC17PCSD61 (Duplicate)	1117535.0762	2055861.8317		X		
NTC17PCSD62	1117851.8329	2055689.9138	X	X		
NTC17PCSD63	1118213.9299	2055593.5558	X	X[2]		X
NTC17PCSD64	1118494.7500	2055807.2319	X	X		X
Reference Locations						
NTC17PCSD65	1117454.2820	2055554.6955	X	X[2]		
NTC17PCSD66	1117300.6111	2055280.3905	X	X		X
NTC17PCSD67	1117356.6995	2054864.0253	X	X[2]		
NTC17PCSD68	1117291.0944	2054466.6536	X	X		X
NTC17PCSD69	1116914.1408	2054909.5684	X	X		
Upstream Locations						
NTC17PCSD70	1116033.7562	2059460.3328		X		
NTC17PCSD71	1116194.3430	2058967.3369		X		
NTC17PCSD72	1116331.5627	2058600.7029		X		

Notes:
Surficial sediment and suspended sediment samples were analyzed for PAHs, select pesticides, PCBs, select metals, and total organic carbon.

X* - Sample combined to provide enough sediment for metal analysis only.
X - Sample collected/analyzed.
NA - Not applicable.

Footnotes:
1 - Midpoint of sampling reach. Coordinates reported as NAD 83 IL East Feet.
2 - Also analyzed for pH.

TABLE 2-2

WATER QUALITY PARAMETERS FOR CREEK REACHES WHERE BENTHIC INVERTEBRATES WERE COLLECTED
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Station ID	Temperature (°C)	Conductivity (ms/cm)	Dissolved Oxygen (mg/L)	pH	Turbidity (NTU)	Odor	Surface Oil	Turbidity Description
NTC17PCSD53	11.4	1.29	11.61	7.98	13	None	Sheen	Slightly turbid
NTC17PCSD54	12.33	1.47	12.68	7.99	14.2	None	Sheen, Flecks	Slightly turbid
NTC17PCSD58	10.04	2.21	11.36	7.78	7.5	None	Sheen	Clear
NTC17PCSD59	14.23	1.65	14.9	8	7.1	None	None	Slightly turbid
NTC17PCSD60	10.59	1.73	13.06	7.85	8.2	None	None	Slightly turbid
NTC17PCSD61	11.02	1.72	9.16	6.91	11.8	None	None	Slightly turbid
NTC17PCSD62	12.34	1.64	10.78	8.33	13.2	None	Sheen	Slightly turbid
NTC17PCSD63	10	1.69	11.44	8.09	7.2	None	Sheen, Flecks	Slightly turbid
NTC17PCSD64	11.86	1.66	12.04	8.35	8.3	None	Sheen	Slightly turbid
NTC17PCSD65	8.77	1.73	14.28	8.05	17.1	None	Sheen	Clear (high turbidity reading from walking in channel)
NTC17PCSD66	10.23	1.65	14.99	8.15	8.5	None	Sheen, Flecks	Clear (elevated turbidity reading from walking in channel)
NTC17PCSD67	12.95	1.42	15.15	8.39	9.1	None	Sheen, Flecks	Clear
NTC17PCSD68	13	1.4	15.52	8.4	4.1	None	Sheen	Slightly turbid
NTC17PCSD69	11.61	2.99	12.88	8.02	1.1	None	Sheen	Clear

NTU - Nephelometric turbidity units

TABLE 2-3

SUMMARY OF COLLECTED QUALITY CONTROL SAMPLES
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Sample ID	Media	Chemistry[1]	TOC	pH	Comments
Field Duplicates					
FD032812-02	Sediment	X	X	X	Duplicate of NTC17PCSD53
FD032812-01	Sediment	X	X		Duplicate of NTC17PCSD61
Equipment Rinsate Blanks					
RB033012-01	Water	X			Rinsate of plastic trowel

Notes:
Blank cell indicates that the sample was not analyzed for that parameter.
X - Analysis performed.

Footnotes:
1 - Analyzed for PAHs, select pesticides, PCBs, and select metals.

Acronyms:
TOC - Total Organic Carbon

TABLE 2-4

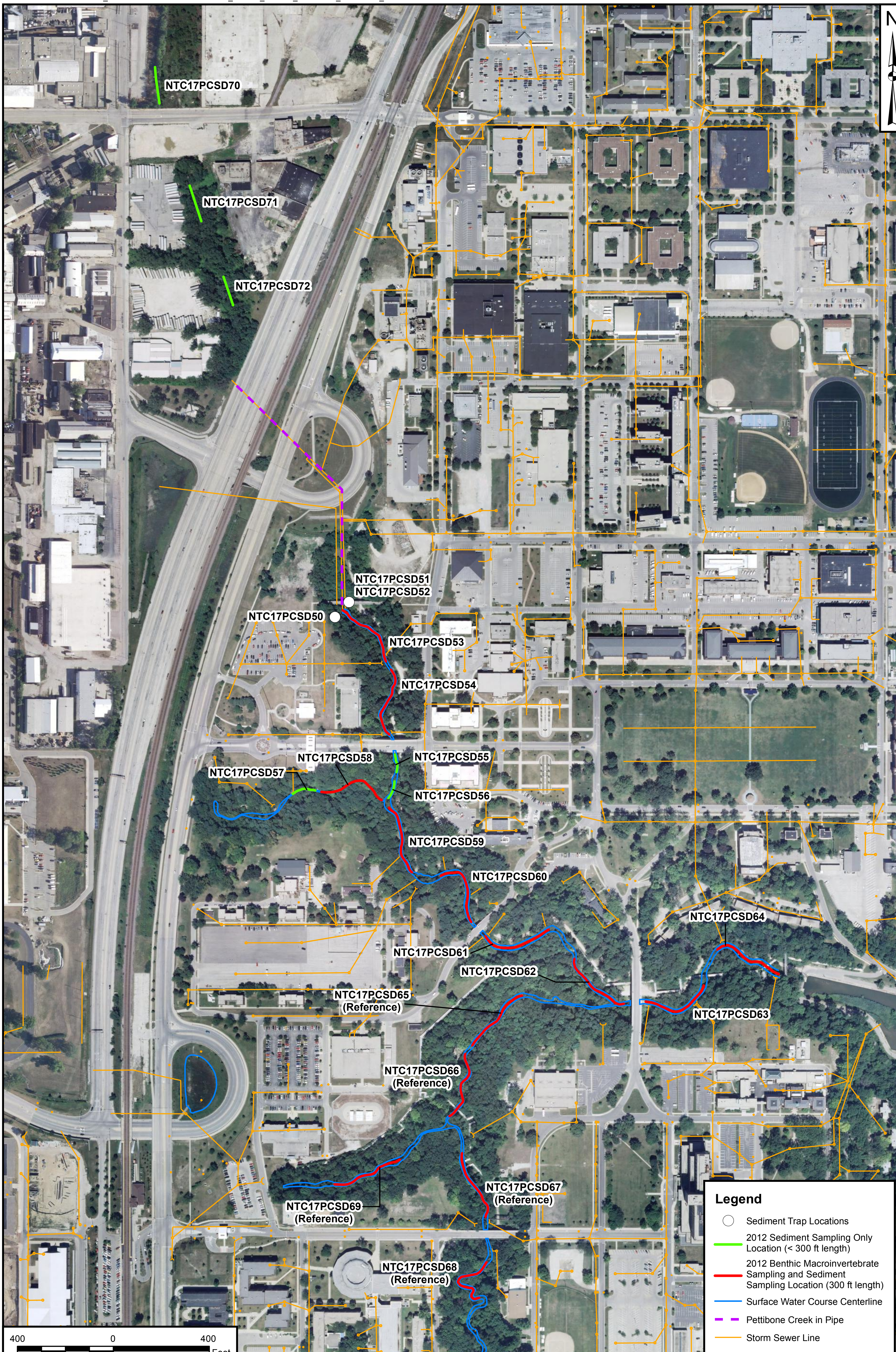
SUMMARY OF GRAIN SIZE ANALYSIS FROM 2001 REMEDIAL INVESTIGATION
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SITE	SITE 17	SITE 17	SITE 17	SITE 17	SITE 17	SITE 17
LOCATION	NTC17PCSD01	NTC17PCSD03	NTC17PCSD15	NTC17PCSD19	NTC17PCSD38	NTC17BBSD53
DEPTH RANGE[1]	At 1 foot	0 - 4 cm	0 - 4 cm	0 - 4 cm	0 - 4 cm	4 cm - 3 feet
SAMPLE ID	NTC17PCSD0102	NTC17PCSD0301	NTC17PCSD1501	NTC17PCSD1901	NTC17PCSD3801	NTC17BBSD5303
SAMPLE DATE	9/24/2001	9/24/2001	9/23/2001	9/22/2001	9/24/2001	9/6/2001
MATRIX	SD	SD	SD	SD	SD	SD
Miscellaneous Parameters (%)						
SIEVE 1"	100	100	100	100	100	100
SIEVE 3/4"	98.42	100	100	100	100	100
SIEVE 1/2"	97.88	100	100	100	100	98.07
SIEVE 3/8"	94.71	100	100	99.56	100	97.88
NO. 4 SIEVE	86.51	99.73	97.8	98.9	99.7	96.55
NO. 10 SIEVE	56.58	99.58	90.6	95.82	98.88	93.89
NO. 20 SIEVE	22.82	98.61	71.22	86.93	97.16	90.53
NO. 40 SIEVE	10.65	86.64	34.5	69.83	91.79	84.63
NO. 60 SIEVE	4.42	47.6	5.31	40.84	49.74	71.56
NO. 140 SIEVE	0.79	14.37	0.76	16.53	14.85	54.32
NO. 200 SIEVE	0.65	11.4	0.69	13.66	12	49.45
USCS SYMBOL	SP	SM	SP	SM	SM	SC
USCS CLASSIFICATION	SAND	SILTY SAND	SAND	SILTY SAND	SILTY SAND	CLAYEY SAND

NTC - Naval Training Center
PC - Pettibone Creek
BB - Boat Basin
SD - Sediment
USCS - Unified Soil Classification System

1 Depth measured below ground surface

PGH P:\GIS\GREATLAKES_NS\MAPDOCS\MXD\PETTIBONE_CREEK_LINEAR_REACHES_CURRENT_STORMPIPE.MXD 07/19/2012 JEE



DRAWN BY	DATE		CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	07/13/12	SAMPLING LOCATIONS	1021	474
CHECKED BY	DATE	PETTIBONE CREEK	APPROVED BY	DATE
L. GANSER	07/19/12	NAVAL STATION GREAT LAKES	—	—
REVISED BY	DATE	GREAT LAKES, ILLINOIS	APPROVED BY	DATE
—	—		—	—
SCALE			FIGURE NO.	REV
AS NOTED		NAVFAC	FIGURE 2-1	0

3.0 EVALUATION OF RESULTS

For this investigation, sediment samples were collected for chemical analysis and toxicity testing, and a benthic invertebrate community survey was performed to determine the health of the benthic community. This is sometimes referred to as the sediment triad approach because three lines of evidence are used to determine whether the benthic community is being impacted. In addition, sediment samples were collected to determine whether there is a continuing upstream source of contamination in Pettibone Creek and to characterize a few reaches in Pettibone Creek where the benthic community survey and toxicity testing was not conducted.

This section presents the results of the sampling, and an evaluation of the data in accordance with the decision rules presented in the SAP (Tetra Tech, 2012). The SAP identified two problems (designated A and B) that needed to be resolved. Both problems are summarized below.

Problem A:
Data on which risks to benthic invertebrates in the North Branch of Pettibone Creek were estimated in the RI/RA are a decade old, and are potentially no longer representative of current risks. The Navy must characterize current risks to benthic invertebrates from exposure to North Branch Pettibone Creek sediment to determine whether remedial action is necessary to reduce risks to acceptable levels.

Problem B:
A continuing source of sediment contamination may persist upstream of Navy property. The Navy needs to determine whether there is a continuing source of contamination to North Branch Pettibone Creek sediments on Navy property, and whether a remedial action is appropriate, in accordance with Navy policy. The policy states that contaminated sediments will not be remediated unless continuing sources of sediment contamination are eliminated.

The remainder of this section is divided into two primary sections to address these problems.

3.1 RISKS TO BENTHIC INVERTEBRATES

The first problem listed above is that the current health of the benthic community in Pettibone Creek is not known. The previous risk assessment conducted in the RI only compared chemical concentrations in sediment to various ecological sediment benchmarks to determine whether potential risks to benthic invertebrates were possible. No site-specific sediment toxicity testing or benthic community studies were conducted as part of the RI.

The three lines of evidence collected as part of this investigation (sediment chemistry, sediment toxicity, and benthic community data) were used to determine whether the benthic community is being impacted. The three lines of evidence were evaluated in accordance with the decision rules presented on Figure 1-1.

The first decision point in the flow chart (Figure 1-1) is to determine whether the collected samples and data are of sufficient type, quantity, and quality, as determined during the DUA, to complete this study. As presented in Section 2.3, the results of the DUA were that the data are adequate to complete the study. Therefore, no additional data need to be collected at this time and the rest of the evaluations presented on Figure 1-1 were conducted and are presented in the following sections.

3.1.1 <u>Benthic Community Survey</u>

The next decision point is to conduct a benthic community survey to determine whether the health of the benthic community in any site creek reach is worse than the health of the benthic community in the reference creek reaches. The details of the survey, including sampling methodology and the data evaluation are presented in Appendix B, which contains the Benthic Macroinvertebrate Conditions and Aquatic Life Habitat Characterization Report. The following paragraphs present a brief summary of the results and conclusions from that report.

The primary metric that was used to evaluate the health of the benthic invertebrate community in Pettibone Creek was the Macroinvertebrate Index of Biotic Integrity (mIBI) (Tetra Tech, 2007). Illinois EPA uses the mIBI as an indicator of biological conditions for assessment of aquatic life uses in their Clean Water Act programs. This index is responsive to a broad range of stressors, and is appropriate for use in assessing conditions in the study area. Measures of the biological sample (metrics) that comprise the index or are otherwise responsive were also valuable for interpreting macroinvertebrate conditions. Some of these metrics, including the mIBI scores, are presented in Table 3-1.

The samples had mIBI scores indicating biologically degraded conditions, with assessment ratings of "Fair" and "Poor." The threshold between "Fair" and "Poor" is 20.9 index points. Although the benthic community survey was conducted during the week of March 26-30, 2012, which is outside of the June to October index period specified by Illinois EPA, the index is still useful for comparing scores between the reference samples and the site samples. In general, the Pettibone Creek reference mIBI scores were in the "Fair" assessment category, and site index values were rated as "Poor"; however, there was some crossover. The small tributaries of both the reference and site samples had the lowest mIBI values in their respective categories. These small tributaries may have intermittent flow, which would be a stressful condition that compounds any stresses caused by water quality conditions; this could lead to the "Poor" mIBI rating assessments. The site samples with scores in the “Fair” range were in the downstream portions of the channel (Figure 3-1).

The scores of each of the metrics were consistently low, with the exceptions of Total Taxa and the Modified Biotic Index (MBI), a composite score of pollution tolerances for individuals), which have moderate scores (Table 3-1). Average metric scores from reference sample were consistently higher than the average of site sample scores.

Taxa with high tolerance values (TV ≥ 7) are considered tolerant of pollution. Seven midge taxa occurred only in reference sites, including Ablabesmyia (TV=6), Dicrotendipes (TV=8), Micropsectra (TV=4), Nanocladius (TV=3), Parachironomus (TV=8), Paraphaenocladius (TV=6), and Rheocricotopus (TV=6). Two tolerant midge taxa were only found in test sites, including Chironomus (TV=11) and Zavrelimyia (TV=8).

Test site NTC17PCSD63 had a high number of taxa (30) and higher than average concentrations of copper, lead, and zinc (see Table 3-2). Five of the 30 taxa (17%) were considered tolerant (tolerance values ≥ 7). In comparison, eight of 31 taxa (26%) were tolerant in reference site NTC17PCSD67, with the highest number of taxa and low concentrations of metals. High diversity does not appear to be due to tolerant taxa in this case. The tolerant taxa that were common to both samples included Oligochaeta, Tanytarsus, Cryptochironomus, and Stenelmis. Unique to the test site was Chironomus, which has the highest possible tolerance value (11).

It appears that taxa diversity was not driven by pollution tolerant taxa. Taxa richness is typically driven by sensitive taxa that tend to occur in lower numbers and to disappear when stresses cause unsuitable conditions. Tolerant taxa are sometimes present in low numbers even when environmental conditions are relatively good and they increase in numbers as conditions worsen. Changes in abundance may have no effect on richness. Using the same samples discussed above, two taxa in the test sample were intolerant of pollution (tolerance values ≤3) as were three taxa in the reference sample.

Taxa in the sensitive insect orders [Ephemeroptera, Plecoptera, and Trichoptera (EPT), mayflies, stoneflies, and caddisflies] are commonly used to indicate biological conditions in streams. Only Trichoptera were found in the samples. Several mayflies are sensitive to metals and stoneflies usually require cold, well-oxygenated waters. The study site has low level metal contamination and may be warm during summer low flows; these are conditions that are not generally suitable for mayflies and stoneflies. The Trichoptera taxa present were the moderately tolerant *Hydropsyche* and *Cheumatopsyche* (Trichoptera: Hydropsychidae). These are net-spinning filter feeders that were equally common in reference and site samples.

The percentage of organisms that scrape substrate surfaces for food resources (% scrapers) (Merritt et al., 2008) were notably higher in reference samples as compared to site samples. If scouring is frequent in the channel, then substrate, food resources, or the scrapers themselves may be carried away during spates.

Densities were calculated from the laboratory subsampling data, and were higher in reference samples than in site samples in most cases (Table 3-1). However, the highest density was found in one of the downstream site samples. Low densities have been linked to stressful habitat and water quality conditions (Gray, 2004).

Stream habitat conditions were characterized using the QHEI (Tetra Tech, 2012), which is calculated by summing scores for six individual measurements of instream and riparian conditions. In addition, the substrate particle size at each sampling location was characterized using systematic random pebble counts. Habitat quality was relatively consistent among locations, with QHEI scores ranging from 52 to 66 at reference locations, and 49.5 to 61 at site locations (Table 3-1). Most of the reference samples had QHEI scores in the “Good” range, as did many of the site samples; most of the site samples which were classified in the “Good” range were located in the downstream portions of the North Branch.

Appendix B presents the habitat evaluation index and use assessment field sheets. Six variables are considered in the overall QHEI score. The habitat variables that were most strongly related to the QHEI score [Pearson correlation coefficient (p) greater than 0.55] were instream cover, channel morphology, pool/glide, and riffle/run quality. Bank erosion and riparian zone, gradient, and substrate were not significantly related to the QHEI score (p greater than 0.05). This may be because of the low variability among samples for these variables. For example, the rating for the gradient variable was 10 at all sites. As can be seen in site photos (Appendix B), the locations have similar characteristics in terms of substrates, channel conditions, and riparian stability and vegetation.

In summary, the biological conditions of the samples were ranked from best to worst based on the mIBI. Within this list, the significance of the different mIBI scores was compared using the 90% confidence interval of ±2.3 index units. The best two reference samples, furthest upstream on the South Branch, have similar mIBI scores that are significantly higher than any others. The locations with mIBI scores significantly worse than the lowest reference score (not including the reference tributary) include site samples NTC17PCSD60, NTC17PCSD53, and NTC17PCSD59, and the two tributary samples. The mIBI scores are included on the site map in Figure 3-1 to help spatially conceptualize the gradient of biological integrity.

3.1.2 Surficial Sediment

Surficial (0 to 4 inches) sediment samples were collected from several locations along Pettibone Creek in 2001 and 2012 to determine whether the chemical concentrations exceed sediment criteria. The 2001 samples were grab samples, while the 2012 samples were composite samples that were collected along 100-foot or 300-foot reaches of the creek.

Table 3-2 presents the detected chemical concentrations in each 2012 sediment sample. Figures 3-3 through 3-5 present the concentrations for select parameters (copper, lead, zinc, and total PAHs) at each sampling location from 2001 and 2012. Figures 3-6 through 3-11 present the chemical concentrations in the 2001 and 2012 samples side by side. However, these figures only show the 2001 results for samples that were collected within the same reaches as the 2012 samples, and only show the 2012 results if there was a 2001 sample collected from within the reach. In some cases, more than one 2001 sample was located within a 2012 reach. In those cases, the reach is listed multiple times on the x-axis, and the result for the associated 2001 sample is next to the 2012 result.

3.1.2.1 Comparison to Sediment Criteria

The concentrations of the detected chemicals in each 2012 sediment sample were compared to the following sediment criteria. Exceedances of the criteria are shown in Table 3-2.

- Baseline Sediment Cleanup Objectives from the Draft Illinois EPA Tiered Approach for Evaluation and Remediation of Petroleum Product Releases to Sediments (Illinois EPA, 2009) were used to evaluate most PAHs.

- USEPA Region 5 Ecological Screening Levels for Sediment (USEPA, 2003) were used to evaluate PCBs, pesticides, metals and benzo(g,h,i)perylene. The Region 5 ecological screening levels for sediment for metals, PCBs, and several of the pesticides are based on the threshold effects concentrations (TECs) from MacDonald et al. (2000).

The sediment criteria for select chemicals are also shown on Figures 3-3 through 3-11. These figures along with the discussion below provide comparisons of the data to the criteria, and the reference reaches to the upstream concentrations.

Individual PAHs exceeded screening levels in several samples and concentrations of total PAHs exceeded the screening level in every sample (see Table 3-2). Two upstream samples from NTC17PCSD71 (33.7mg/kg) and NTC17PCSD72 (116 mg/kg) and three site samples from NTC17PCSD53 (90 mg/kg), NTC17PCSD54 (34.7 mg/kg), and NTC17PCSD60 (25 mg/kg) had total PAH concentrations exceeding the alternative sediment cleanup objective of 23 milligrams per kilogram (mg/kg) (Illinois EPA, 2009). Sample location NTC17PCSD72 with the highest total PAH concentration is upstream of NSGL property, and just downstream of a large stormwater outfall that discharges runoff from North Chicago. Because a large portion of the area is paved and there is a lot of vehicular traffic, the runoff is likely a large source of the PAHs to the sediment in Pettibone Creek. The next greatest concentration of total PAHs was at NTC17PCSD53, which was located near the point where the North Branch of Pettibone Creek enters NSGL property.

One PCB, Aroclor-1260, was detected in 5 of 20 samples. One upstream sample location (NTC17PCSD70) had a PCB concentration slightly exceeding the calculated baseline sediment cleanup objective for total PCBs (0.0598 mg/kg). The samples had PCB concentrations well below the probable effects concentration (PEC) of 0.676 mg/kg based on toxicity to sediment-dwelling organisms (MacDonald, et al., 2000).

Concentrations of pesticides in several samples exceeded screening levels. Total DDT exceeded its calculated baseline sediment cleanup objective based on 4,4’-DDT (0.0042 mg/kg) in the samples, except one upstream sample; however, the total DDT concentrations were below the PEC of 0.572 mg/kg (MacDonald, et al., 2000). One other pesticide, endosulfan II exceeded screening levels in several samples. Maximum detected concentrations of total DDT (0.31 mg/kg) and endosulfan II (0.0033 mg/kg) are relatively low, and are indicative of typical spraying activities and not an intentional or accidental release of pesticides to the creek.

Only one sample (at upstream location NTC17PCSD70) had an arsenic concentration (13.5 mg/kg) exceeding the screening level (9.79 mg/kg); however, this concentration was well below the PEC of 33 mg/kg (MacDonald, et al., 2000). Two upstream sample locations had cadmium concentrations (1.32 J and 2.4 J mg/kg) exceeding the screening level (0.99 mg/kg); however, these concentrations also were well below the PEC of 4.98 mg/kg (MacDonald, et al., 2000). All chromium concentrations were less than the screening level (43.4 mg/kg). Concentrations of copper, lead, mercury, and zinc exceeded their respective screening levels in several samples. Sediment from two upstream sample locations (NTC17PCSD70 and NTC17PCSD71) and one site sample location (NTC17PCSD55) exceeded the copper PEC of 149 mg/kg, and the zinc PEC of 459 mg/kg (MacDonald, et al., 2000). Lead concentrations in two upstream samples exceeded the PEC of 128 mg/kg (MacDonald, et al., 2000). No mercury concentrations exceeded the PEC of 1.06 mg/kg; and most samples had mercury concentrations well below this value, except one upstream location (NTC17PCSD71) which had a mercury concentration of 0.96 mg/kg.

In summary, based on this comparison, it appears that the chemicals that have the greatest potential for impacting benthic invertebrates at the site are copper, lead, zinc, and total PAHs.

3.1.2.2 Comparison of Site Samples to Reference Samples

Table 3-3 presents the detected site sediment concentrations compared to the maximum reference sample concentration. Chemical concentrations in the site samples were generally greater than the concentrations in the reference samples with a few exceptions. However, chemical concentrations from the North Branch tributary and a few other sample locations in the North Branch were similar to the concentrations in the reference samples (see Figures 3-3 through 3-5).

3.1.2.3 Comparison of Current Concentrations to Historical Data

The analytical data from the current sampling investigation was compared to data from the 2001 sampling investigation to determine whether concentrations have decreased over time (Figures 3-3 through 3-11). The 2001 samples were collected from the same depth interval (0 to 4 cm) as the current samples; however, the 2001 samples were grab samples while the current samples were composite samples.

Figures 3-3 through 3-5 present the chemical concentrations for select parameters (copper, lead, zinc, and total PAHs) at each sampling location from 2001 and 2012. Figures 3-6 through 3-11 were prepared for the same parameters, but also include plots for total PCBs and total DDT. The chemical concentrations are also compared to screening criteria and higher effects level benchmarks for informational purposes.

The plots indicate a general decrease in chemical concentrations between 2001 and 2012 for the metals, PCBs, and pesticides. In fact, PCBs were not even detected in most of the 2012 samples. Exceptions were in the site samples collected downstream of the confluence of the North and South Branches, and in the reference samples where concentrations of metals were slightly greater in the 2012 samples. For PAHs, however, the opposite was observed because several of the concentrations in the 2012 samples were similar to or greater than the concentrations in the 2001 samples.

3.1.3 <u>Sediment Toxicity Testing</u>

Sediment toxicity testing was performed to help assess risks to sediment invertebrates, and to develop cleanup goals, if necessary. Whole sediment toxicity tests conducted for this investigation were 10-day tests using *Hyalella azteca* as the test species and were initiated on May 15, 2012. The endpoints of the tests were mortality as measured by survival, and growth as measured by dry weight. The sediment samples used for the test were collected along with the samples for chemical analysis. The tests were conducted on one laboratory control sample, two reference samples, and six site samples. The two reference samples were collected from the South Branch of Pettibone Creek which is known to have not been impacted by site activities. Details of the toxicity test are presented in Appendix E. The results of the sediment toxicity testing are presented in Table 3-4. Mean survival of *H. azteca* in the site samples ranged from 82.5 to 93.8 percent, and ranged from 87.5 to 95 percent in the reference samples. Survival was acceptable in all samples (because it was greater than 80%) and mean survival in site samples was not significantly different than survival in the reference samples (see Appendix E). Mean growth of *H. azteca* in site samples ranged from 0.083 to 0.12 mg dry weight, and ranged from 0.11 to 0.15 mg, dry weight in the reference samples. Mean growth results in some of the site samples were significantly different than mean growth in reference sample NTC17PCSD66. However, this sample had much greater growth (0.15 mg) compared to the other reference sample (NTC17PCSD68) (0.11 mg). Mean growth results in none of the site samples were significantly different than mean growth in reference sample NTC17PCSD68, so growth is not considered impacted in any of the site samples. Toxicity concentration plots presented in Appendix E do not indicate a correlation between sediment concentrations and toxicity test results. Because none of the site samples are considered toxic based on the results of the toxicity tests, No Observed Effects Concentrations (NOECs) for benthic invertebrates were determined using the greatest concentration detected in site samples that were used for toxicity testing. The NOECs are presented in Table 3-5.

3.1.4 Risk to Benthic Invertebrates Summary/Conclusions

As presented above, biological conditions in the Pettibone Creek stream channels on the NSGL base are somewhat or severely impaired, as indicated from the mIBI scores, and the conditions in the site samples are generally lower than the biological conditions in the reference samples. If the samples had been collected during the June to October index period specified by Illinois EPA instead of in March, the scores may have been slightly higher, perhaps improving ratings for some locations into the “Good” assessment category. This could be because some insect taxa, which have small developmental stages in winter may not have been identified in the samples, but had they grown, would have been more readily identified in summer samples. An increase in insect taxa would probably result in increased mIBI scores.

The biological index and the QHEI were highly correlated ($r = 0.69$) (see Appendix B), with the regression coefficient ($r^2 = 0.48$) suggesting that 48% of the variability in the biological index can be attributed to the QHEI and 52% of the variability is due to other factors. There are obvious limitations to the benthic macroinvertebrate assemblage that are due to habitat conditions. For example, the habitat quality, as measured by the QHEI, was positively related to the percentage of fine particles in the samples, suggesting that one of the major habitat stressors is the high storm flows with channel scouring effects. In the downstream half of the North Branch (where site samples were collected), index scores/habitat quality were similar to those in the downstream reference samples (South Branch). Having better benthic communities in the downstream reaches of Pettibone Creek support the suggestion that the habitat is an important factor in the benthic health in Pettibone Creek.

Based on the sediment chemistry results, concentrations of contaminants (primarily PAHs and metals such as copper, lead, and zinc) are generally higher in the North Branch of Pettibone Creek compared to the South Branch. Several plots were prepared to determine if any of the metric scores were correlated to chemical concentrations (see Appendix B). The chemicals that were plotted included copper, lead, zinc, and total PAHs; while the metrics that were plotted included the mIBI, total Taxa, EPT Percent Score, and density. There does not appear to be a correlation between chemical concentrations in the sediment and any of the metrics, which indicates that sediment chemistry may not be the reason for the "poor" to "fair" benthic community health ratings. The results of the toxicity testing support this conclusion as mean survival and mean growth in site samples were not statistically different from one or both reference samples. A summary of benthic indicators, sediment chemistry, and toxicity testing is presented in Table 3-6. In general, the greatest concentrations for select metals and PAHs in sediment with low mIBI indices were from locations NTC17PCSD53 and NTC17PCSD60. NTC17PCSD53 is the farthest upstream location on NSGL property.

3.2 UPSTREAM CONTINUING SEDIMENT CONTAMINATION SOURCE

To determine whether there is a continuing upstream source of contamination to Pettibone Creek, two types of samples were collected. Surficial sediment samples were collected in Pettibone Creek from three locations upstream of where the creek enters NSGL to determine whether the upstream sediment is contaminated. Also, two suspended sediment samples were collected from sediment traps to determine whether contaminated sediment is entrained in Pettibone Creek surface water before it enters the NSGL property boundary.

3.2.1 Comparison of Upstream Samples to Site Samples

Three surficial sediment samples (NTC17PCSD70, NTC17PCSD71, and NTC17PCSD72) were collected in Pettibone Creek, upstream of NSGL property (see Figure 3-2). The analytical results from sediment samples collected from these locations are presented in Table 3-2, and the results for select parameters are presented on Figures 3-3 through 3-5. Table 3-7 lists the maximum detected concentrations in the upstream sediment samples compared to the concentrations in the downstream samples. With the exception of a few pesticides, all of the maximum detected concentrations were in the upstream sediment samples. However, as discussed above, the concentrations of pesticides were generally pretty low throughout Pettibone Creek.

Maximum concentrations of metals and PCBs were generally detected in the farthest upstream sampling location (NTC17PCSD70). Although the greatest PCB concentrations were detected in the upstream samples, PCBs are generally not at significant concentrations in Pettibone Creek, as discussed above in Section 3.1.2.1. The elevated metal concentrations are likely reflective of the manufacturing facilities that existed in this area as discussed in Section 1.3. It is not known whether the concentrations in the sediment represent historical discharges, or whether there are current sources of metals that are still discharging to Pettibone Creek. However, the fact that elevated concentrations of metals were found in the upstream samples indicates that the upstream sediment may be a continuing source of contamination to the downstream portion of Pettibone Creek. Because current concentrations of metals in the downstream portion of Pettibone Creek have generally decreased from the concentrations found in 2001, it suggests that the current source of metals contamination to the creek has likely decreased.

Maximum concentrations of PAHs were detected in the sampling location NTC17PCSD72, which is located immediately downstream of a storm sewer collecting water/runoff from a large section of the City of North Chicago. Also, as discussed above in Section 3.1.2.3, concentrations of PAHs in several of the 2012 samples were greater than or similar to the results in the 2001 samples. These results suggest that upstream sources are continuing to contribute to the elevated PAHs concentrations detected in Pettibone Creek downstream of where the creek enters the NSGL property.

3.2.2 Suspended Sediment Comparison to Sediment Criteria

Suspended sediment samples were collected from sediment traps positioned at the North Branch northern entry point onto NSGL property to evaluate the presence of an upstream continuing source of sediment contamination. The suspended sediment sample from NTC17PCSD50 was analyzed for the same suite of parameters as the surficial sediment samples. Suspended sediment from NTC17PCSD51 and NTC17PCSD52 were combined into a single sample in order to obtain sufficient sample for analysis. However, the combined sample NTCPCSD51-52 only provided enough sediment for metals analysis. The analytical results from suspended sediment samples along with a comparison to the ecological sediment screening criteria are presented in Table 3-8. Table 3-9 lists the maximum detected concentrations in the suspended sediment samples compared to the concentrations in the site and reference samples.

The combined sample NTC17PCSD51-52 was collected from culverts that carry Pettibone Creek under the highway interchange and also receives stormwater drainage from the former manufacturing facilities area and the northern parts of NSGL (see Figure 2-1). This sample had higher metals concentrations compared to sample NTC17PCSD50, which was collected from a culvert that received stormwater drainage from other industrial areas (see Table 3-8). The elevated metal concentrations in sample NTC17PCSD51-52 are likely reflective of the former manufacturing facilities that existed in this area as discussed in Section 1.3. As observed on Table 3-9, the maximum detected concentrations of most metals were in the suspended sediment samples. Although grain size analysis was not conducted on the suspended sediment samples, it was expected that the sediment traps would preferentially collect the smaller sized sediment particles, because these are the particles that would be entrained in the water column. Typically, contaminant concentrations are greater in finer sediment than they are in coarser sediments. Therefore, the metals concentrations detected in the suspended sediment samples may be biased high. Nevertheless, the elevated concentrations of metals in the suspended sediment entering Navy property indicates that there are continuing sources of metals contamination to Pettibone Creek, upstream of where it enters the Navy property.

PAH, pesticide, and PCB data were only available from sample NTC17PCSD50. Several PAH and pesticide concentrations were lower in the suspended sediment sample compared to several upstream (NTC17PCSD70 through NTC17PCSD72), site (NTC17PCSD53 through NTC17PCSD56, NTC17PCSD60, NTC17PCSD61, and NTC17PCSD64), and reference (NTC17PCSD69) locations while PCB concentrations were higher in the suspended sediment sample compared to all locations. As discussed above for metals, the higher concentrations may be somewhat related to the finer particles that were likely collected in the sediment traps. Again, the suspended sediment results suggest that upstream sources are continuing to contribute to the chemical concentrations detected in Pettibone Creek downstream of where the creek enters the NSGL property.

TABLE 3-1

SUMMARY OF BENTHIC COMMUNITY RESULTS
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

StationID	mIBI		Total Taxa	EPT % Score	Scraper % Score	MBI score	Density	QHEI	
	Score	Rating						Score	Rating
Reference Samples									
NTC17PCSD65	21.3	Fair	21	4.83	25.34	42.22	3980	62.5	Good
NTC17PCSD66	24.1	Fair	29	4.67	23.37	46.59	2565	58.5	Good
NTC17PCSD67	30.3	Fair	31	4.9	35.42	51.35	2741	55.5	Good
NTC17PCSD68	30.5	Fair	30	1.01	36.56	68.19	4388	66	Good
NTC17PCSD69(1)	13.3	Poor	17	4.1	11.52	40.58	2756	52	Fair
Site Samples									
NTC17PCSD53	14*	Poor	21	0	2.26	38.92	1806	54	Fair
NTC17PCSD54	19.4	Poor	22	0.49	4.91	51.22	2085	49.5	Fair
NTC17PCSD58(1)	10.4*	Poor	13	0	1.1	32.24	1389	49.5	Fair
NTC17PCSD59	12.6*	Poor	20	2.36	3.54	38.81	2419	49.5	Fair
NTC17PCSD60	17.2*	Poor	25	7.36	3.94	54.98	837	59.5	Good
NTC17PCSD61	21.3	Fair	25	4.5	5.01	74.33	984	61	Good
NTC17PCSD62	20.8	Poor	28	0.52	11.61	41.48	1157	56.5	Good
NTC17PCSD63	23.5	Fair	30	0.9	14.59	41.33	2595	61	Good
NTC17PCSD64	20.2	Poor	24	2.81	11.69	32.37	5569	56.5	Good

1 - These samples were located in the tributaries to Pettibone Creek
* - Sample has a statistically lower mIBI score as compared to the lowest reference sample mIBI, not including the reference tributary.
mIBI - Macroinvertebrate Index of Biotic Integrity
EPT - Ephemeroptera, Plecoptera, and Trichoptera
MBI - Modified Biotic Index
QHEI - Qualitative Habitat Evaluation Index

TABLE 3-2

DETECTED CHEMICAL CONCENTRATIONS IN SEDIMENT COMPARED TO SCREENING CRITERIA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS
PAGE 1 OF 2

SAMPLE ID	**Sediment Screening Level**		NTC17PCSD53	NTC17PCSD54	NTC17PCSD55	NTC17PCSD56	NTC17PCSD57	NTC17PCSD58	NTC17PCSD59	NTC17PCSD60	NTC17PCSD61	NTC17PCSD62	NTC17PCSD63	NTC17PCSD64
LOCATION			SITE	SITE	SITE	SITE	SITE, TRIB	SITE, TRIB	SITE	SITE	SITE	SITE	SITE	SITE
SAMPLE DATE			03/28/12	03/28/12	03/27/12	03/27/12	03/27/12	03/29/12	03/28/12	03/28/12	03/28/12	03/27/12	03/27/12	03/27/12
TOP DEPTH (FEET)			0	0	0	0	0	0	0	0	0	0	0	0
BOTTOM DEPTH (FEET)	**Value**	**Source**	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
POLYNUCLEAR AROMATIC HYDROCARBONS (MG/KG)														
2-METHYLNAPHTHALENE	0.086	Illinois EPA Tier 1	0.212 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0408 J	0.0443 U	0.0428 U	0.049 U
ACENAPHTHENE	0.58	Illinois EPA Tier 1	1.41 J	0.388	0.118	0.078 J	0.0206 U	0.0215 J	0.0447 U	0.112	0.165 J	0.0613 J	0.0428 U	0.0724 J
ACENAPHTHYLENE	0.68	Illinois EPA Tier 1	0.0482 U	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0217 U	0.0443 U	0.0428 U	0.049 U
ANTHRACENE	0.057	Illinois EPA Tier 1	2.43 J	1.34	0.306	0.26	0.0527	0.0567	0.0805 J	0.376	0.564 J	0.203	0.135	0.26
BENZO(A)ANTHRACENE	0.11	Illinois EPA Tier 1	6.38 J	2.09	1.36	1.07	0.196	0.231	0.296	1.48	0.955 J	0.708	0.586	0.961
BENZO(A)PYRENE	0.057	Illinois EPA Tier 1	5.69 J	2.44	1.72	1.29	0.238	0.248	0.397	1.85	0.933 J	0.846	0.705	1.13
BENZO(B)FLUORANTHENE	0.75	Illinois EPA Tier 1	5.76 J	2.31	2.09	1.5	0.258	0.275	0.424	2.15	0.943 J	0.876	0.809	1.25
BENZO(G,H,I)PERYLENE	0.17	Region 5	2.82 J	1.55	1.24	1.05	0.188	0.168	0.322	1.31	0.609 J	0.594	0.515	0.838
BENZO(K)FLUORANTHENE	3.6	Illinois EPA Tier 1	6.15 J	2.68	1.71	1.3	0.25	0.289	0.455	2.09	0.919 J	0.831	0.752	1.18
CHRYSENE	0.17	Illinois EPA Tier 1	7.07 J	2.47	1.93	1.56	0.269	0.332	0.44	2.17	1.04 J	0.842	0.757	1.33
DIBENZO(A,H)ANTHRACENE	0.033	Illinois EPA Tier 1	0.933 J	0.595	0.419	0.34	0.046	0.0424 J	0.105	0.508	0.252 J	0.179	0.162	0.285
FLUORANTHENE	2.8	Illinois EPA Tier 1	18.4 J	6.75	4.38	3.6	0.619	0.74	0.977	5.14	3.02 J	2.27	1.9	3.04
FLUORENE	0.035	Illinois EPA Tier 1	1.44 J	0.535	0.126	0.0905	0.0206 U	0.0214 U	0.0447 U	0.159	0.237 J	0.0443 U	0.0515 J	0.101
INDENO(1,2,3-CD)PYRENE	0.31	Illinois EPA Tier 1	3.13 J	1.44	1.1	1.01	0.146	0.156	0.31	1.3	0.568 J	0.553	0.457	0.786
NAPHTHALENE	0.15	Illinois EPA Tier 1	0.473 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.0712 J	0.0306 J	0.0443 U	0.0428 U	0.049 U
PHENANTHRENE	0.81	Illinois EPA Tier 1	13.4 J	4.96	1.96	1.66	0.291	0.398	0.465	2.32	2.39 J	1.08	0.873	1.46
PYRENE	0.2	Illinois EPA Tier 1	14.5 J	5.12	3.36	2.73	0.486	0.578	0.746	3.97	2.22 J	1.77	1.48	2.33
TOTAL PAHS	1.6	Illinois EPA Tier 1	90.2 J	34.7	21.8	17.5 J	3.04	3.54 J	5.02 J	25 J	14.9 J	10.8 J	9.18 J	15 J
PESTICIDES (MG/KG)														
4,4'-DDD	0.0049	Region 5	0.0138 J	0.0197 J	0.025 J	0.236 J	0.00203 J	0.00249 J	0.00637 J	0.0218 J	0.00829 J	0.0427 J	0.0665 J	0.0484 J
4,4'-DDE	0.0032	Region 5	0.0629 J	0.0491 J	0.036 J	0.131 J	0.00411 J	0.00631	0.0139 J	0.0259 J	0.0179 J	0.0366 J	0.112 J	0.0425 J
4,4'-DDT	0.0042	Region 5	0.0311 J	0.00814 J	0.0342 J	0.0526 J	0.00063 J	0.00073 J	0.00559 J	0.0361 J	0.00456 J	0.0432 J	0.134 J	0.0662 J
ALDRIN	0.0032	Region 5	0.00048 UJ	0.00046 U	0.00039 U	0.00211 U	0.0004 U	0.00041 U	0.00045 U	0.00054 U	0.00043 U	0.00055 J	0.00215 U	0.00047 U
ALPHA-CHLORDANE	0.224	Region 5	0.00048 U	0.00046 U	0.00059 J	0.00211 U	0.0004 U	0.00029 J	0.00045 U	0.00054 U	0.00043 U	0.00045 U	0.00215 U	0.00047 U
ENDOSULFAN II	0.0019	Region 5	0.00187 J	0.00111	0.00228 J	0.00333 J	0.0009	0.0004 J	0.00027 J	0.00297	0.00046 J	0.00023 J	0.00215 U	0.00134
GAMMA-CHLORDANE	0.224	Region 5	0.00567 U	0.00171	0.0006 J	0.00666 J	0.00329 J	0.00315 U	0.00081 J	0.00288	0.00068 J	0.00028 J	0.00185 J	0.00046 J
TOTAL DDT POS	0.0042	Region 5	0.108 J	0.0769 J	0.0952 J	0.42 J	0.00677 J	0.00953 J	0.0259 J	0.0838 J	0.0308 J	0.122 J	0.312 J	0.157 J
PCBS (MG/KG)														
AROCLOR-1260	0.0598	Region 5	0.0121 U	0.0117 U	0.0352 J	0.0586 J	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0263 J	0.0543 U	0.0119 U
METALS (MG/KG)														
ARSENIC	9.79	Region 5	9.46	7.26	5.55	6.79	5.54	7.47	7.34	6.94	8.02	5.57	6.67	7.77
CADMIUM	0.99	Region 5	0.445 J	0.717 U	0.398 J	0.451 J	0.61 U	0.627 U	0.69 U	0.454 J	0.678 U	0.789 J	0.39 J	0.707 U
CHROMIUM	43.4	Region 5	23.4	19.2	14.3	17.7	15.6	15.8	19.1	18	15.2	19.9	26.5	13.9
COPPER	31.6	Region 5	68.3	43.5 J	222 J	62.2 J	37.2 J	34.7	46.2 J	89.6 J	28.5 J	50.6 J	70.3 J	92.3 J
LEAD	35.8	Region 5	96.7	30	109	67.5	21.8	29	29.6	56.8	15.4	33.7	102	64.8
MERCURY	0.174	Region 5	0.17	0.124	0.159	0.181	0.0442	0.0329 J	0.0652	0.132	0.0289 J	0.171	0.157	0.22
ZINC	121	Region 5	384 J	131	1180	224	96.7	107 J	141	329	85.5 J	56.7	299	357
MISCELLANEOUS PARAMETERS (S.U.)														
PH	NA	NA	7.63	NA	NA	NA	NA	7.73	7.65	NA	7.75	NA	7.4	NA
MISCELLANEOUS PARAMETERS (MG/KG)														
TOTAL ORGANIC CARBON	NA	NA	22000 J	18900	18600	22800	17900	11900	11600	36700	11000 J	24100	10200	22100

TABLE 3-2

DETECTED CHEMICAL CONCENTRATIONS IN SEDIMENT COMPARED TO SCREENING CRITERIA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	**Sediment Screening Level**		NTC17PCSD65	NTC17PCSD66	NTC17PCSD67	NTC17PCSD68	NTC17PCSD69	NTC17PCSD70	NTC17PCSD71	NTC17PCSD72
LOCATION			REF	REF	REF	REF	REF, TRIB	UPSTREAM	UPSTREAM	UPSTREAM
SAMPLE DATE			03/29/12	03/29/12	03/29/12	03/29/12	03/29/12	03/28/12	03/28/12	03/28/12
TOP DEPTH (FEET)			0	0	0	0	0	0	0	0
BOTTOM DEPTH (FEET)	**Value**	**Source**	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
POLYNUCLEAR AROMATIC HYDROCARBONS (MG/KG)										
2-METHYLNAPHTHALENE	0.086	Illinois EPA Tier 1	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.047 U	0.144 U	0.0927 U	0.413
ACENAPHTHENE	0.58	Illinois EPA Tier 1	0.0261 U	0.0622 J	0.054 U	0.0533 U	0.0604 J	0.144 U	0.165 J	1.82
ACENAPHTHYLENE	0.68	Illinois EPA Tier 1	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.047 U	0.144 U	0.0927 U	0.0881 U
ANTHRACENE	0.057	Illinois EPA Tier 1	0.0399 J	0.185	0.181	0.0533 U	0.047 U	0.144 U	0.0927 U	2.61
BENZO(A)ANTHRACENE	0.11	Illinois EPA Tier 1	0.158	0.684	0.752	0.208	0.99	0.758	1.91	7.14
BENZO(A)PYRENE	0.057	Illinois EPA Tier 1	0.17	0.576	0.625	0.218	1.16	1.2	2.62	7.8
BENZO(B)FLUORANTHENE	0.75	Illinois EPA Tier 1	0.201	0.683	0.653	0.267	1.32	1.62	2.89	7.08
BENZO(G,H,I)PERYLENE	0.17	Region 5	0.127	0.328	0.288	0.149	0.737	1.08	2.1	4.63
BENZO(K)FLUORANTHENE	3.6	Illinois EPA Tier 1	0.196	0.707	0.645	0.252	1.35	1.18	2.94	8.56
CHRYSENE	0.17	Illinois EPA Tier 1	0.254	0.902	0.734	0.292	1.68	1.18	2.81	8.81
DIBENZO(A,H)ANTHRACENE	0.033	Illinois EPA Tier 1	0.038 J	0.158	0.0922 J	0.0533 U	0.207	0.144 U	0.689	1.91
FLUORANTHENE	2.8	Illinois EPA Tier 1	0.475	1.96	1.86	0.564	3.46	2.16	6.8	21.9
FLUORENE	0.035	Illinois EPA Tier 1	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.0872 J	0.144 U	0.215	1.76
INDENO(1,2,3-CD)PYRENE	0.31	Illinois EPA Tier 1	0.107	0.325	0.296	0.124	0.683	0.925	1.9	4.53
NAPHTHALENE	0.15	Illinois EPA Tier 1	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.047 U	0.144 U	0.0927 U	1.6
PHENANTHRENE	0.81	Illinois EPA Tier 1	0.197	1.04	0.528	0.23	1.67	0.813	3.38	17.8
PYRENE	0.2	Illinois EPA Tier 1	0.386	1.49	1.4	0.448	2.83	1.77	5.3	17.2
TOTAL PAHS	1.6	Illinois EPA Tier 1	2.35 J	9.1 J	8.05 J	2.75	16.2 J	12.7	33.7 J	116
PESTICIDES (MG/KG)										
4,4'-DDD	0.0049	Region 5	0.00608 J	0.0234 J	0.0147 J	0.0254 J	0.0063 J	0.00079 J	0.00087 J	0.00096 J
4,4'-DDE	0.0032	Region 5	0.00601	0.026	0.0225	0.0323	0.0142	0.00221 J	0.00036 J	0.00037 J
4,4'-DDT	0.0042	Region 5	0.0008 J	0.00469 J	0.00915 J	0.00414 J	0.00794 J	0.00073 UJ	0.00375 J	0.00414 J
ALDRIN	0.0032	Region 5	0.00029 J	0.0005 U	0.00051 J	0.00069 J	0.00046 U	0.00073 U	0.00072 J	0.00044 U
ALPHA-CHLORDANE	0.224	Region 5	0.00053 U	0.0005 U	0.00169	0.00055 U	0.00046 U	0.00073 U	0.00047 U	0.00044 U
ENDOSULFAN II	0.0019	Region 5	0.00057 J	0.00205	0.00137	0.00118 J	0.00165 J	0.00224 J	0.00245	0.0025
GAMMA-CHLORDANE	0.224	Region 5	0.00318 U	0.00065 U	0.00079 U	0.00192 U	0.00037 U	0.00392 J	0.00263	0.00301 J
TOTAL DDT POS	0.0042	Region 5	0.0129 J	0.0541 J	0.0464 J	0.0618 J	0.0284 J	0.003 J	0.00498 J	0.00547 J
PCBS (MG/KG)										
AROCLOR-1260	0.0598	Region 5	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0707 J	0.0118 U	0.025 J
METALS (MG/KG)										
ARSENIC	9.79	Region 5	6.34	6.91	6.45	6.46	7.59	13.5	5.41	6.73
CADMIUM	0.99	Region 5	0.808 U	0.725 U	0.805 U	0.0866 J	0.703 U	2.4 J	1.32 J	0.679 U
CHROMIUM	43.4	Region 5	17.8	17.8	17.7	11	20.7	33.2	22.9	21.3
COPPER	31.6	Region 5	26.6	36.8	31	27.4	40.6	390 J	251 J	94.3 J
LEAD	35.8	Region 5	24	33.8	25.8	24.6	53.6	220	144	29.7
MERCURY	0.174	Region 5	0.0654	0.169	0.632	0.203	0.061	0.366	0.96	0.193
ZINC	121	Region 5	91.8 J	144 J	104 J	96 J	146 J	1580 J	848	300 J
MISCELLANEOUS PARAMETERS (S.U.)										
PH	NA	NA	7.34	NA	7.21	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)										
TOTAL ORGANIC CARBON	NA	NA	13900	18100	29000	21500	33100	71300	29000	12900 J

Notes:
Shaded cells indicate an exceedance of the sediment screening level.

Abbreviations:
J - Estimated value
U - Nondetected result
NA - Not available/Not applicable
TRIB - Tributary
REF - Reference

Sources:

Illinois EPA Tier 1 - Draft Illinois EPA Tiered Approach for Evaluation and Remediation of Petroleum Product Releases to Sediments (Illinois EPA, 2009)
Region 5 – USEPA Region 5 Ecological Screening Levels, Sediment (USEPA, 2003)

TABLE 3-3

DETECTED SITE AND UPSTREAM CONCENTRATIONS COMPARED TO MAXIMUM REFERENCE CONCENTRATION
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	Maximum Reference Concentration	NTC17PCSD53	NTC17PCSD54	NTC17PCSD55	NTC17PCSD56	NTC17PCSD57	NTC17PCSD58	NTC17PCSD59	NTC17PCSD60	NTC17PCSD61	NTC17PCSD62	NTC17PCSD63	NTC17PCSD64	NTC17PCSD70	NTC17PCSD71	NTC17PCSD72
LOCATION		SITE	SITE	SITE	SITE	SITE, TRIB	SITE, TRIB	SITE	SITE	SITE	SITE	SITE	SITE	UPSTREAM	UPSTREAM	UPSTREAM
SAMPLE DATE		03/28/12	03/28/12	03/27/12	03/27/12	03/27/12	03/29/12	03/28/12	03/28/12	03/28/12	03/27/12	03/27/12	03/27/12	03/28/12	03/28/12	03/28/12
TOP DEPTH (FEET)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOTTOM DEPTH (FEET)		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
POLYNUCLEAR AROMATIC HYDROCARBONS (MG/KG)																
2-METHYLNAPHTHALENE	0.054 U	0.212 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0408 J	0.0443 U	0.0428 U	0.049 U	0.144 U	0.0927 U	0.413
ACENAPHTHENE	0.0622 J	1.41 J	0.388	0.118	0.078 J	0.0206 U	0.0215 J	0.0447 U	0.112	0.165 J	0.0613 J	0.0428 U	0.0724 J	0.144 U	0.165 J	1.82
ACENAPHTHYLENE	0.054 U	0.0482 U	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0217 U	0.0443 U	0.0428 U	0.049 U	0.144 U	0.0927 U	0.0881 U
ANTHRACENE	0.185	2.43 J	1.34	0.306	0.26	0.0527	0.0567	0.0805 J	0.376	0.564 J	0.203	0.135	0.26	0.144 U	0.0927 U	2.61
BENZO(A)ANTHRACENE	0.99	6.38 J	2.09	1.36	1.07	0.196	0.231	0.296	1.48	0.955 J	0.708	0.586	0.961	0.758	1.91	7.14
BENZO(A)PYRENE	1.16	5.69 J	2.44	1.72	1.29	0.238	0.248	0.397	1.85	0.933 J	0.846	0.705	1.13	1.2	2.62	7.8
BENZO(B)FLUORANTHENE	1.32	5.76 J	2.31	2.09	1.5	0.258	0.275	0.424	2.15	0.943 J	0.876	0.809	1.25	1.62	2.89	7.08
BENZO(G,H,I)PERYLENE	0.737	2.82 J	1.55	1.24	1.05	0.188	0.168	0.322	1.31	0.609 J	0.594	0.515	0.838	1.08	2.1	4.63
BENZO(K)FLUORANTHENE	1.35	6.15 J	2.68	1.71	1.3	0.25	0.289	0.455	2.09	0.919 J	0.831	0.752	1.18	1.18	2.94	8.56
CHRYSENE	1.68	7.07 J	2.47	1.93	1.56	0.269	0.332	0.44	2.17	1.04 J	0.842	0.757	1.33	1.18	2.81	8.81
DIBENZO(A,H)ANTHRACENE	0.207	0.933 J	0.595	0.419	0.34	0.046	0.0424 J	0.105	0.508	0.252 J	0.179	0.162	0.285	0.144 U	0.689	1.91
FLUORANTHENE	3.46	18.4 J	6.75	4.38	3.6	0.619	0.74	0.977	5.14	3.02 J	2.27	1.9	3.04	2.16	6.8	21.9
FLUORENE	0.0872 J	1.44 J	0.535	0.126	0.0905	0.0206 U	0.0214 U	0.0447 U	0.159	0.237 J	0.0443 U	0.0515 J	0.101	0.144 U	0.215	1.76
INDENO(1,2,3-CD)PYRENE	0.683	3.13 J	1.44	1.1	1.01	0.146	0.156	0.31	1.3	0.568 J	0.553	0.457	0.786	0.925	1.9	4.53
NAPHTHALENE	0.054 U	0.473 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.0712 J	0.0306 J	0.0443 U	0.0428 U	0.049 U	0.144 U	0.0927 U	1.6
PHENANTHRENE	1.67	13.4 J	4.96	1.96	1.66	0.291	0.398	0.465	2.32	2.39 J	1.08	0.873	1.46	0.813	3.38	17.8
PYRENE	2.83	14.5 J	5.12	3.36	2.73	0.486	0.578	0.746	3.97	2.22 J	1.77	1.48	2.33	1.77	5.3	17.2
TOTAL PAHS	16.2 J	90.2 J	34.7	21.8	17.5 J	3.04	3.54 J	5.02 J	25 J	14.9 J	10.8 J	9.18 J	15 J	12.7	33.7 J	116
TOTAL PAHS HALFND	16.3 J	90.2 J	34.8	21.9	17.6 J	3.09	3.58 J	5.13 J	25.1 J	14.9 J	10.9 J	9.27 J	15.1 J	13.2	33.9 J	116
PESTICIDES (MG/KG)																
4,4'-DDD	0.0254 J	0.0138 J	0.0197 J	0.025 J	0.236 J	0.00203 J	0.00249 J	0.00637 J	0.0218 J	0.00829 J	0.0427 J	0.0665 J	0.0484 J	0.00079 J	0.00087 J	0.00096 J
4,4'-DDE	0.0323	0.0629 J	0.0491 J	0.036 J	0.131 J	0.00411 J	0.00631	0.0139 J	0.0259 J	0.0179 J	0.0366 J	0.112 J	0.0425 J	0.00221 J	0.00036 J	0.00037 J
4,4'-DDT	0.00915 J	0.0311 J	0.00814 J	0.0342 J	0.0526 J	0.00063 J	0.00073 J	0.00559 J	0.0361 J	0.00456 J	0.0432 J	0.134 J	0.0662 J	0.00073 UJ	0.00375 J	0.00414 J
ALDRIN	0.00069 J	0.00048 UJ	0.00046 U	0.00039 U	0.00211 U	0.0004 U	0.00041 U	0.00045 U	0.00054 U	0.00043 U	0.00055 J	0.00215 U	0.00047 U	0.00073 U	0.00072 J	0.00044 U
ALPHA-CHLORDANE	0.00169	0.00048 U	0.00046 U	0.00059 J	0.00211 U	0.0004 U	0.00029 J	0.00045 U	0.00054 U	0.00043 U	0.00045 U	0.00215 U	0.00047 U	0.00073 U	0.00047 U	0.00044 U
ENDOSULFAN II	0.00205	0.00187 J	0.00111	0.00228 J	0.00333 J	0.0009	0.0004 J	0.00027 J	0.00297	0.00046 J	0.00023 J	0.00215 U	0.00134	0.00224 J	0.00245	0.0025
GAMMA-CHLORDANE	0.00318 U	0.00567 U	0.00171	0.0006 J	0.00666 J	0.00329 J	0.00315 U	0.00081 J	0.00288	0.00068 J	0.00028 J	0.00185 J	0.00046 J	0.00392 J	0.00263	0.00301 J
TOTAL DDT HALFND	0.0618 J	0.108 J	0.0769 J	0.0952 J	0.42 J	0.00677 J	0.00953 J	0.0259 J	0.0838 J	0.0308 J	0.122 J	0.312 J	0.157 J	0.00337 J	0.00498 J	0.00547 J
TOTAL DDT POS	0.0618 J	0.108 J	0.0769 J	0.0952 J	0.42 J	0.00677 J	0.00953 J	0.0259 J	0.0838 J	0.0308 J	0.122 J	0.312 J	0.157 J	0.003 J	0.00498 J	0.00547 J
PCBS (MG/KG)																
AROCLOR-1260	0.0139 U	0.0121 U	0.0117 U	0.0352 J	0.0586 J	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0263 J	0.0543 U	0.0119 U	0.0707 J	0.0118 U	0.025 J
METALS (MG/KG)																
ARSENIC	7.59	9.46	7.26	5.55	6.79	5.54	7.47	7.34	6.94	8.02	5.57	6.67	7.77	13.5	5.41	6.73
CADMIUM	0.808 U	0.445 J	0.717 U	0.398 J	0.451 J	0.61 U	0.627 U	0.69 U	0.454 J	0.678 U	0.789 J	0.39 J	0.707 U	2.4 J	1.32 J	0.679 U
CHROMIUM	20.7	23.4	19.2	14.3	17.7	15.6	15.8	19.1	18	15.2	19.9	26.5	13.9	33.2	22.9	21.3
COPPER	40.6	68.3	43.5 J	222 J	62.2 J	37.2 J	34.7	46.2 J	89.6 J	28.5 J	50.6 J	70.3 J	92.3 J	390 J	251 J	94.3 J
LEAD	53.6	96.7	30	109	67.5	21.8	29	29.6	56.8	15.4	33.7	102	64.8	220	144	29.7
MERCURY	0.632	0.17	0.124	0.159	0.181	0.0442	0.0329 J	0.0652	0.132	0.0289 J	0.171	0.157	0.22	0.366	0.96	0.193
ZINC	146 J	384 J	131	1180	224	96.7	107 J	141	329	85.5 J	56.7	299	357	1580 J	848	300 J
MISCELLANEOUS PARAMETERS (S.U.)																
PH	7.34	7.63	NA	NA	NA	NA	7.73	7.65	NA	7.75	NA	7.4	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)																
TOTAL ORGANIC CARBON	33100	22000 J	18900	18600	22800	17900	11900	11600	36700	11000 J	24100	10200	22100	71300	29000	12900 J

Notes:
Shaded cells indicate an exceedance of the maximum reference concentration (samples NTC17PCSD65 to NTC17PCSD69).

Abbreviations:
J - Estimated value
U - Nondetected result
NA - Not available/Not applicable
TRIB - Tributary

TABLE 3-4

SUMMARY OF *HYALELLA AZTECA* SURVIVAL AND GROWTH RESULTS
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Station ID	Mean Survival (%)	Mean Weight of Survivors (mg)[1]	Mean Growth (mg)[2]
Laboratory Control			
	97.5	0.08925	0.0875
Reference Samples			
NTC17PCSD66	95	0.1606	0.15
NTC17PCSD68	87.5	0.124	0.1088
Site Samples			
NTC17PCSD53	88.8	0.116	0.1025
NTC17PCSD54	92.5	0.1286	0.1175
NTC17PCSD60	86.3	0.1069	0.0912
NTC17PCSD61	93.8	0.0955	0.0875
NTC17PCSD63	93.8	0.1281	0.12
NTC17PCSD64	82.5	0.103	0.0825

Appendix E presents the complete laboratory report for the toxicity tests.

1 - Dry weight, Mean weight of all survivors
2 - Dry weight, Individual weight based on 10 organisms per chamber

TABLE 3-5

DETERMINATION OF SEDIMENT NO OBSERVED EFFECTS CONCENTRATIONS
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Parameter	NOEC	NTC17PCSD53	NTC17PCSD54	NTC17PCSD60	NTC17PCSD61	NTC17PCSD63	NTC17PCSD64	NTC17PCSD66	NTC17PCSD68
POLYNUCLEAR AROMATIC HYDROCARBONS (MG/KG)									
2-METHYLNAPHTHALENE	0.212 J	**0.212 J**	0.0929 U	0.055 U	0.0408 J	0.0428 U	0.049 U	0.0485 U	0.0533 U
ACENAPHTHENE	1.41 J	**1.41 J**	0.388	0.112	0.165 J	0.0428 U	0.0724 J	0.0622 J	0.0533 U
ACENAPHTHYLENE	0.0929 U	0.0482 U	**0.0929 U**	0.055 U	0.0217 U	0.0428 U	0.049 U	0.0485 U	0.0533 U
ANTHRACENE	2.43 J	**2.43 J**	1.34	0.376	0.564 J	0.135	0.26	0.185	0.0533 U
BENZO(A)ANTHRACENE	6.38 J	**6.38 J**	2.09	1.48	0.955 J	0.586	0.961	0.684	0.208
BENZO(A)PYRENE	5.69 J	**5.69 J**	2.44	1.85	0.933 J	0.705	1.13	0.576	0.218
BENZO(B)FLUORANTHENE	5.76 J	**5.76 J**	2.31	2.15	0.943 J	0.809	1.25	0.683	0.267
BENZO(G,H,I)PERYLENE	2.82 J	**2.82 J**	1.55	1.31	0.609 J	0.515	0.838	0.328	0.149
BENZO(K)FLUORANTHENE	6.15 J	**6.15 J**	2.68	2.09	0.919 J	0.752	1.18	0.707	0.252
CHRYSENE	7.07 J	**7.07 J**	2.47	2.17	1.04 J	0.757	1.33	0.902	0.292
DIBENZO(A,H)ANTHRACENE	0.933 J	**0.933 J**	0.595	0.508	0.252 J	0.162	0.285	0.158	0.0533 U
FLUORANTHENE	18.4 J	**18.4 J**	6.75	5.14	3.02 J	1.9	3.04	1.96	0.564
FLUORENE	1.44 J	**1.44 J**	0.535	0.159	0.237 J	0.0515 J	0.101	0.0485 U	0.0533 U
INDENO(1,2,3-CD)PYRENE	3.13 J	**3.13 J**	1.44	1.3	0.568 J	0.457	0.786	0.325	0.124
NAPHTHALENE	0.473 J	**0.473 J**	0.0929 U	0.0712 J	0.0306 J	0.0428 U	0.049 U	0.0485 U	0.0533 U
PHENANTHRENE	13.4 J	**13.4 J**	4.96	2.32	2.39 J	0.873	1.46	1.04	0.23
PYRENE	14.5 J	**14.5 J**	5.12	3.97	2.22 J	1.48	2.33	1.49	0.448
TOTAL PAHS	90.2 J	**90.2 J**	34.7	25 J	14.9 J	9.18 J	15 J	9.1 J	2.75
PESTICIDES (MG/KG)									
4,4'-DDD	0.0665 J	0.0138 J	0.0197 J	0.0218 J	0.00829 J	**0.0665 J**	0.0484 J	0.0234 J	0.0254 J
4,4'-DDE	0.112 J	0.0629 J	0.0491 J	0.0259 J	0.0179 J	**0.112 J**	0.0425 J	0.026	0.0323
4,4'-DDT	0.134 J	0.0311 J	0.00814 J	0.0361 J	0.00456 J	**0.134 J**	0.0662 J	0.00469 J	0.00414 J
ALDRIN	0.0007 J	0.0005 UJ	0.00046 U	0.00054 U	0.00043 U	0.00215 U	0.00047 U	0.0005 U	**0.00069 J**
ALPHA-CHLORDANE	0.0022 U	0.0005 U	0.00046 U	0.00054 U	0.00043 U	**0.00215 U**	0.00047 U	0.0005 U	0.00055 U
ENDOSULFAN II	0.003	0.0019 J	0.00111	**0.00297**	0.00046 J	0.00215 U	0.00134	0.00205	0.00118 J
GAMMA-CHLORDANE	0.0029	0.0057 U	0.00171	**0.00288**	0.00068 J	0.00185 J	0.00046 J	0.00065 U	0.00192 U
TOTAL DDT POS	0.312 J	0.108 J	0.0769 J	0.0838 J	0.0308 J	**0.312 J**	0.157 J	0.0541 J	0.0618 J
PCBS (MG/KG)									
AROCLOR-1260	0.0543 U	0.0121 U	0.0117 U	0.0136 U	0.0109 U	**0.0543 U**	0.0119 U	0.0125 U	0.0138 U
METALS (MG/KG)									
ARSENIC	9.46	**9.46**	7.26	6.94	8.02	6.67	7.77	6.91	6.46
CADMIUM	0.454 J	0.445 J	0.717 U	**0.454 J**	0.678 U	0.39 J	0.707 U	0.725 U	0.0866 J
CHROMIUM	26.5	23.4	19.2	18	15.2	**26.5**	13.9	17.8	11
COPPER	92.3 J	68.3	43.5 J	89.6 J	28.5 J	70.3 J	**92.3 J**	36.8	27.4
LEAD	102	96.7	30	56.8	15.4	**102**	64.8	33.8	24.6
MERCURY	0.22	0.17	0.124	0.132	0.0289 J	0.157	**0.22**	0.169	0.203
ZINC	384 J	**384 J**	131	329	85.5 J	299	357	144 J	96 J

Shaded cells are the maximum detected concentrations for each parameter. If the parameter was not detected in any sample, than the maximum detection limit is shaded.
NOEC - No observed effects concentration (maximum detected concentration in the toxicity test samples because none of the samples were considered toxic)

TABLE 3-6

COMPARISON OF BENTHIC COMMUNITY RESULTS, SEDIMENT CHEMISTRY, AND TOXICITY TESTING
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

	Benthic Community Indicators			Sediment Chemistry Concentrations (mg/kg)				Toxicity Test Results	
StationID	**mIBI**	**Index Rating**	**QHEI score**	**Copper**	**Lead**	**Zinc**	**PAHs**	**Percent Survival**	**Growth**
Reference Samples									
NTC17PCSD65	21.3	Fair	62.5	26.6	24	91.8	2.4	NA	NA
NTC17PCSD66	24.1	Fair	58.5	36.8	33.8	144	9.1	95	0.15
NTC17PCSD67	30.3	Fair	55.5	31	25.8	104	8.1	NA	NA
NTC17PCSD68	30.5	Fair	66	27.4	24.6	96	2.8	87.5	0.1088
NTC17PCSD69[1]	13.3	Poor	**52**	40.6	53.6	146	**16.2**	NA	NA
Site Samples									
NTC17PCSD53	**14**	**Poor**	**54**	**68.3**	**96.7**	**384**	**90.2**	88.8	0.1025
NTC17PCSD54	19.4	Poor	**49.5**	43.5	30	131	**34.7**	92.5	0.1175
NTC17PCSD58[1]	**10.4**	**Poor**	**49.5**	34.7	29	107	3.5	NA	NA
NTC17PCSD59	**12.6**	**Poor**	**49.5**	46.2	29.6	141	5	NA	NA
NTC17PCSD60	**17.2**	**Poor**	59.5	**89.6**	**56.8**	**329**	**25**	86.3	0.0912
NTC17PCSD61	21.3	Fair	61	28.5	15.4	85.5	14.9	93.8	0.0875
NTC17PCSD62	20.8	Poor	56.5	50.6	33.7	56.7	10.8	NA	NA
NTC17PCSD63	23.5	Fair	61	**70.3**	**102**	**299**	9.2	93.8	0.12
NTC17PCSD64	20.2	Poor	56.5	**92.3**	**64.8**	**357**	15	82.5	0.0825

Footnotes:
1 - These samples were located in the tributaries to Pettibone Creek

Shading Rationale:

Benthic Community Indicator:
- mIBI > 2.3 index units lower than lowest reference sample index (excluding reference tributary)
- QHEI score less than 55 which is the threshold between good and fair conditions.

Sediment Chemistry:
- Four greatest concentrations for each parameter.

Toxicity Test:
-Survival less than 80 percent or growth statistically different than both reference samples (none met these criteria).

mIBI - Macroinvertebrate Index of Biotic Integrity
QHEI - Qualitative Habitat Evaluation Index
NA - Not applicable

TABLE 3-7

DETECTED SITE CONCENTRATIONS COMPARED TO MAXIMUM UPSTREAM CONCENTRATION
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	Maximum Upstream Concentration	NTC17PCSD53	NTC17PCSD54	NTC17PCSD55	NTC17PCSD56	NTC17PCSD57	NTC17PCSD58	NTC17PCSD59	NTC17PCSD60	NTC17PCSD61	NTC17PCSD62	NTC17PCSD63	NTC17PCSD64
LOCATION		SITE	SITE	SITE	SITE	SITE, TRIB	SITE, TRIB	SITE	SITE	SITE	SITE	SITE	SITE
SAMPLE DATE		03/28/12	03/28/12	03/27/12	03/27/12	03/27/12	03/29/12	03/28/12	03/28/12	03/28/12	03/27/12	03/27/12	03/27/12
TOP DEPTH (FEET)		0	0	0	0	0	0	0	0	0	0	0	0
BOTTOM DEPTH (FEET)		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
POLYNUCLEAR AROMATIC HYDROCARBONS (MG/KG)													
2-METHYLNAPHTHALENE	0.413	0.212 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0408 J	0.0443 U	0.0428 U	0.049 U
ACENAPHTHENE	1.82	1.41 J	0.388	0.118	0.078 J	0.0206 U	0.0215 J	0.0447 U	0.112	0.165 J	0.0613 J	0.0428 U	0.0724 J
ACENAPHTHYLENE	0.144 U	0.0482 U	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0217 U	0.0443 U	0.0428 U	0.049 U
ANTHRACENE	2.61	2.43 J	1.34	0.306	0.26	0.0527	0.0567	0.0805 J	0.376	0.564 J	0.203	0.135	0.26
BENZO(A)ANTHRACENE	7.14	6.38 J	2.09	1.36	1.07	0.196	0.231	0.296	1.48	0.955 J	0.708	0.586	0.961
BENZO(A)PYRENE	7.8	5.69 J	2.44	1.72	1.29	0.238	0.248	0.397	1.85	0.933 J	0.846	0.705	1.13
BENZO(B)FLUORANTHENE	7.08	5.76 J	2.31	2.09	1.5	0.258	0.275	0.424	2.15	0.943 J	0.876	0.809	1.25
BENZO(G,H,I)PERYLENE	4.63	2.82 J	1.55	1.24	1.05	0.188	0.168	0.322	1.31	0.609 J	0.594	0.515	0.838
BENZO(K)FLUORANTHENE	8.56	6.15 J	2.68	1.71	1.3	0.25	0.289	0.455	2.09	0.919 J	0.831	0.752	1.18
CHRYSENE	8.81	7.07 J	2.47	1.93	1.56	0.269	0.332	0.44	2.17	1.04 J	0.842	0.757	1.33
DIBENZO(A,H)ANTHRACENE	1.91	0.933 J	0.595	0.419	0.34	0.046	0.0424 J	0.105	0.508	0.252 J	0.179	0.162	0.285
FLUORANTHENE	21.9	18.4 J	6.75	4.38	3.6	0.619	0.74	0.977	5.14	3.02 J	2.27	1.9	3.04
FLUORENE	1.76	1.44 J	0.535	0.126	0.0905	0.0206 U	0.0214 U	0.0447 U	0.159	0.237 J	0.0443 U	0.0515 J	0.101
INDENO(1,2,3-CD)PYRENE	4.53	3.13 J	1.44	1.1	1.01	0.146	0.156	0.31	1.3	0.568 J	0.553	0.457	0.786
NAPHTHALENE	1.6	0.473 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.0712 J	0.0306 J	0.0443 U	0.0428 U	0.049 U
PHENANTHRENE	17.8	13.4 J	4.96	1.96	1.66	0.291	0.398	0.465	2.32	2.39 J	1.08	0.873	1.46
PYRENE	17.2	14.5 J	5.12	3.36	2.73	0.486	0.578	0.746	3.97	2.22 J	1.77	1.48	2.33
TOTAL PAHS	116	90.2 J	34.7	21.8	17.5 J	3.04	3.54 J	5.02 J	25 J	14.9 J	10.8 J	9.18 J	15 J
PESTICIDES (MG/KG)													
4,4'-DDD	0.00096 J	0.0138 J	0.0197 J	0.025 J	0.236 J	0.00203 J	0.00249 J	0.00637 J	0.0218 J	0.00829 J	0.0427 J	0.0665 J	0.0484 J
4,4'-DDE	0.00221 J	0.0629 J	0.0491 J	0.036 J	0.131 J	0.00411 J	0.00631	0.0139 J	0.0259 J	0.0179 J	0.0366 J	0.112 J	0.0425 J
4,4'-DDT	0.00414 J	0.0311 J	0.00814 J	0.0342 J	0.0526 J	0.00063 J	0.00073 J	0.00559 J	0.0361 J	0.00456 J	0.0432 J	0.134 J	0.0662 J
ALDRIN	0.00072	0.00048 UJ	0.00046 U	0.00039 U	0.00211 U	0.0004 U	0.00041 U	0.00045 U	0.00054 U	0.00043 U	0.00055 J	0.00215 U	0.00047 U
ALPHA-CHLORDANE	0.00073 U	0.00048 U	0.00046 U	0.00059 J	0.00211 U	0.0004 U	0.00029 J	0.00045 U	0.00054 U	0.00043 U	0.00045 U	0.00215 U	0.00047 U
ENDOSULFAN II	0.0025	0.00187 J	0.00111	0.00228 J	0.00333 J	0.0009	0.0004 J	0.00027 J	0.00297	0.00046 J	0.00023 J	0.00215 U	0.00134
GAMMA-CHLORDANE	0.00392 J	0.00567 U	0.00171	0.0006 J	0.00666 J	0.00329 J	0.00315 U	0.00081 J	0.00288	0.00068 J	0.00028 J	0.00185 J	0.00046 J
TOTAL DDT POS	0.00547 J	0.108 J	0.0769 J	0.0952 J	0.42 J	0.00677 J	0.00953 J	0.0259 J	0.0838 J	0.0308 J	0.122 J	0.312 J	0.157 J
PCBS (MG/KG)													
AROCLOR-1260	0.0707 J	0.0121 U	0.0117 U	0.0352 J	0.0586 J	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0263 J	0.0543 U	0.0119 U
METALS (MG/KG)													
ARSENIC	13.5	9.46	7.26	5.55	6.79	5.54	7.47	7.34	6.94	8.02	5.57	6.67	7.77
CADMIUM	2.4 J	0.445 J	0.717 U	0.398 J	0.451 J	0.61 U	0.627 U	0.69 U	0.454 J	0.678 U	0.789 J	0.39 J	0.707 U
CHROMIUM	33.2	23.4	19.2	14.3	17.7	15.6	15.8	19.1	18	15.2	19.9	26.5	13.9
COPPER	390 J	68.3	43.5 J	222 J	62.2 J	37.2 J	34.7	46.2 J	89.6 J	28.5 J	50.6 J	70.3 J	92.3 J
LEAD	220	96.7	30	109	67.5	21.8	29	29.6	56.8	15.4	33.7	102	64.8
MERCURY	0.96	0.17	0.124	0.159	0.181	0.0442	0.0329 J	0.0652	0.132	0.0289 J	0.171	0.157	0.22
ZINC	1580 J	384 J	131	1180	224	96.7	107 J	141	329	85.5 J	56.7	299	357
MISCELLANEOUS PARAMETERS (S.U.)													
PH	7.34	7.63	NA	NA	NA	NA	7.73	7.65	NA	7.75	NA	7.4	NA
MISCELLANEOUS PARAMETERS (MG/KG)													
TOTAL ORGANIC CARBON	33100	22000 J	18900	18600	22800	17900	11900	11600	36700	11000 J	24100	10200	22100

Notes:
Shaded cells indicate an exceedance of the maximum upstream concentration (samples NTC17PCSD70 to NTC17PCSD72).

Abbreviations:
J - Estimated value
U - Nondetected result
NA - Not available/Not applicable
TRIB - Tributary

TABLE 3-8

DETECTED CHEMICAL CONCENTRATIONS IN SUSPENDED SEDIMENT COMPARED TO SCREENING CRITERIA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

NSAMPLE	Sediment Screening Level		NTC17PCSD50	NTC17PCSD51-52
SAMPLE DATE	Value	Source	06/14/2012	06/14/2012
POLYNUCLEAR AROMATIC HYDROCARBONS (MG/KG)				
2-METHYLNAPHTHALENE	0.086	Illinois EPA Tier 1	0.0357 U	NA
ACENAPHTHENE	0.58	Illinois EPA Tier 1	0.0808	NA
ACENAPHTHYLENE	0.68	Illinois EPA Tier 1	0.0357 U	NA
ANTHRACENE	0.057	Illinois EPA Tier 1	0.165	NA
BENZO(A)ANTHRACENE	0.11	Illinois EPA Tier 1	0.722	NA
BENZO(A)PYRENE	0.057	Illinois EPA Tier 1	0.922	NA
BENZO(B)FLUORANTHENE	0.75	Illinois EPA Tier 1	1.11	NA
BENZO(G,H,I)PERYLENE	0.17	Region 5	0.552	NA
BENZO(K)FLUORANTHENE	3.6	Illinois EPA Tier 1	1.02	NA
CHRYSENE	0.17	Illinois EPA Tier 1	1.06	NA
DIBENZO(A,H)ANTHRACENE	0.033	Illinois EPA Tier 1	0.123	NA
FLUORANTHENE	2.8	Illinois EPA Tier 1	2.38	NA
FLUORENE	0.035	Illinois EPA Tier 1	0.0858	NA
INDENO(1,2,3-CD)PYRENE	0.31	Illinois EPA Tier 1	0.526	NA
NAPHTHALENE	0.15	Illinois EPA Tier 1	0.0357 U	NA
PHENANTHRENE	0.81	Illinois EPA Tier 1	1.19	NA
PYRENE	0.2	Illinois EPA Tier 1	1.84	NA
TOTAL PAHS	1.6	Illinois EPA Tier 1	11.8	NA
PESTICIDES (MG/KG)				
4,4'-DDD	0.0049	Region 5	0.00173 UJ	NA
4,4'-DDE	0.0032	Region 5	0.00335 J	NA
4,4'-DDT	0.0042	Region 5	0.00793 J	NA
ALDRIN	0.0032	Region 5	0.00173 U	NA
ALPHA-CHLORDANE	0.224	Region 5	0.00173 U	NA
ENDOSULFAN II	0.0019	Region 5	0.00473 J	NA
GAMMA-CHLORDANE	0.224	Region 5	0.00961 J	NA
TOTAL DDT POS	0.0042	Region 5	0.0113	NA
PCBS (MG/KG)				
AROCLOR-1260	0.0598	Region 5	0.334 J	NA
METALS (MG/KG)				
ARSENIC	9.79	Region 5	27	8.94
CADMIUM	0.99	Region 5	0.823	1.44
CHROMIUM	43.4	Region 5	16.3	31.9
COPPER	31.6	Region 5	104	509
LEAD	35.8	Region 5	62.7	258
MERCURY	0.174	Region 5	0.257 J	0.892 J
ZINC	121	Region 5	482	2960

Notes:
Shaded cells indicate an exceedance of the sediment screening level.

Sources:
Illinois EPA Tier 1 - Draft Illinois EPA Tiered Approach for Evaluation and Remediation of Petroleum Product Releases to Sediments (Illinois EPA, 2009)
Region 5 – USEPA Region 5 Ecological Screening Levels, Sediment (USEPA, 2003)

Abbreviations:
J - Estimated value
U - Nondetected result
NA - Not analyzed

TABLE 3-9

DETECTED CHEMICAL CONCENTRATIONS IN SEDIMENT COMPARED TO MAXIMUM SUSPENDED SEDIMENT CONCENTRATION
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	**Maximum Suspended Sediment Concentration**	NTC17PCSD53	NTC17PCSD54	NTC17PCSD55	NTC17PCSD56	NTC17PCSD57	NTC17PCSD58	NTC17PCSD59	NTC17PCSD60	NTC17PCSD61	NTC17PCSD62	NTC17PCSD63	NTC17PCSD64
LOCATION		SITE	SITE	SITE	SITE	SITE, TRIB	SITE, TRIB	SITE	SITE	SITE	SITE	SITE	SITE
SAMPLE DATE		03/28/12	03/28/12	03/27/12	03/27/12	03/27/12	03/29/12	03/28/12	03/28/12	03/28/12	03/27/12	03/27/12	03/27/12
TOP DEPTH (FEET)		0	0	0	0	0	0	0	0	0	0	0	0
BOTTOM DEPTH (FEET)		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
POLYNUCLEAR AROMATIC HYDROCARBONS (MG/KG)													
2-METHYLNAPHTHALENE	0.0357 U	0.212 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0408 J	0.0443 U	0.0428 U	0.049 U
ACENAPHTHENE	0.0808	1.41 J	0.388	0.118	0.078 J	0.0206 U	0.0215 J	0.0447 U	0.112	0.165 J	0.0613 J	0.0428 U	0.0724 J
ACENAPHTHYLENE	0.0357 U	0.0482 U	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.055 U	0.0217 U	0.0443 U	0.0428 U	0.049 U
ANTHRACENE	0.165	2.43 J	1.34	0.306	0.26	0.0527	0.0567	0.0805 J	0.376	0.564 J	0.203	0.135	0.26
BENZO(A)ANTHRACENE	0.722	6.38 J	2.09	1.36	1.07	0.196	0.231	0.296	1.48	0.955 J	0.708	0.586	0.961
BENZO(A)PYRENE	0.922	5.69 J	2.44	1.72	1.29	0.238	0.248	0.397	1.85	0.933 J	0.846	0.705	1.13
BENZO(B)FLUORANTHENE	1.11	5.76 J	2.31	2.09	1.5	0.258	0.275	0.424	2.15	0.943 J	0.876	0.809	1.25
BENZO(G,H,I)PERYLENE	0.552	2.82 J	1.55	1.24	1.05	0.188	0.168	0.322	1.31	0.609 J	0.594	0.515	0.838
BENZO(K)FLUORANTHENE	1.02	6.15 J	2.68	1.71	1.3	0.25	0.289	0.455	2.09	0.919 J	0.831	0.752	1.18
CHRYSENE	1.06	7.07 J	2.47	1.93	1.56	0.269	0.332	0.44	2.17	1.04 J	0.842	0.757	1.33
DIBENZO(A,H)ANTHRACENE	0.123	0.933 J	0.595	0.419	0.34	0.046	0.0424 J	0.105	0.508	0.252 J	0.179	0.162	0.285
FLUORANTHENE	2.38	18.4 J	6.75	4.38	3.6	0.619	0.74	0.977	5.14	3.02 J	2.27	1.9	3.04
FLUORENE	0.0858	1.44 J	0.535	0.126	0.0905	0.0206 U	0.0214 U	0.0447 U	0.159	0.237 J	0.0443 U	0.0515 J	0.101
INDENO(1,2,3-CD)PYRENE	0.526	3.13 J	1.44	1.1	1.01	0.146	0.156	0.31	1.3	0.568 J	0.553	0.457	0.786
NAPHTHALENE	0.0357 U	0.473 J	0.0929 U	0.0389 U	0.0426 U	0.0206 U	0.0214 U	0.0447 U	0.0712 J	0.0306 J	0.0443 U	0.0428 U	0.049 U
PHENANTHRENE	1.19	13.4 J	4.96	1.96	1.66	0.291	0.398	0.465	2.32	2.39 J	1.08	0.873	1.46
PYRENE	1.84	14.5 J	5.12	3.36	2.73	0.486	0.578	0.746	3.97	2.22 J	1.77	1.48	2.33
TOTAL PAHS	11.8	90.2 J	34.7	21.8	17.5 J	3.04	3.54 J	5.02 J	25 J	14.9 J	10.8 J	9.18 J	15 J
PESTICIDES (MG/KG)													
4,4'-DDD	0.0017 UJ	0.0138 J	0.0197 J	0.025 J	0.236 J	0.00203 J	0.00249 J	0.00637 J	0.0218 J	0.00829 J	0.0427 J	0.0665 J	0.0484 J
4,4'-DDE	0.0034 J	0.0629 J	0.0491 J	0.036 J	0.131 J	0.00411 J	0.00631	0.0139 J	0.0259 J	0.0179 J	0.0366 J	0.112 J	0.0425 J
4,4'-DDT	0.0079 J	0.0311 J	0.00814 J	0.0342 J	0.0526 J	0.00063 J	0.00073 J	0.00559 J	0.0361 J	0.00456 J	0.0432 J	0.134 J	0.0662 J
ALDRIN	0.0017 U	0.00048 UJ	0.00046 U	0.00039 U	0.00211 U	0.0004 U	0.00041 U	0.00045 U	0.00054 U	0.00043 U	0.00055 J	0.00215 U	0.00047 U
ALPHA-CHLORDANE	0.0017 U	0.00048 U	0.00046 U	0.00059 J	0.00211 U	0.0004 U	0.00029 J	0.00045 U	0.00054 U	0.00043 U	0.00045 U	0.00215 U	0.00047 U
ENDOSULFAN II	0.0047 J	0.00187 J	0.00111	0.00228 J	0.00333 J	0.0009	0.0004 J	0.00027 J	0.00297	0.00046 J	0.00023 J	0.00215 U	0.00134
GAMMA-CHLORDANE	0.0096 J	0.00567 U	0.00171	0.0006 J	0.00666 J	0.00329 J	0.00315 U	0.00081 J	0.00288	0.00068 J	0.00028 J	0.00185 J	0.00046 J
TOTAL DDT POS	0.0113	0.108 J	0.0769 J	0.0952 J	0.42 J	0.00677 J	0.00953 J	0.0259 J	0.0838 J	0.0308 J	0.122 J	0.312 J	0.157 J
PCBS (MG/KG)													
AROCLOR-1016	0.0438 U	0.0121 U	0.0117 U	0.0098 U	0.0532 U	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0113 U	0.0543 U	0.0119 U
AROCLOR-1221	0.0438 U	0.0121 U	0.0117 U	0.0098 U	0.0532 U	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0113 U	0.0543 U	0.0119 U
AROCLOR-1232	0.0438 U	0.0121 U	0.0117 U	0.0098 U	0.0532 U	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0113 U	0.0543 U	0.0119 U
AROCLOR-1242	0.0438 U	0.0121 U	0.0117 U	0.0098 U	0.0532 U	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0113 U	0.0543 U	0.0119 U
AROCLOR-1248	0.0438 U	0.0121 U	0.0117 U	0.0098 U	0.0532 U	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0113 U	0.0543 U	0.0119 U
AROCLOR-1254	0.0438 U	0.0121 U	0.0117 U	0.0098 U	0.0532 U	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0113 U	0.0543 U	0.0119 U
AROCLOR-1260	0.334 J	0.0121 U	0.0117 U	0.0352 J	0.0586 J	0.0102 U	0.0103 U	0.0113 U	0.0136 U	0.0109 U	0.0263 J	0.0543 U	0.0119 U
METALS (MG/KG)													
ARSENIC	27	9.46	7.26	5.55	6.79	5.54	7.47	7.34	6.94	8.02	5.57	6.67	7.77
CADMIUM	1.44	0.445 J	0.717 U	0.398 J	0.451 J	0.61 U	0.627 U	0.69 U	0.454 J	0.678 U	0.789 J	0.39 J	0.707 U
CHROMIUM	31.9	23.4	19.2	14.3	17.7	15.6	15.8	19.1	18	15.2	19.9	26.5	13.9
COPPER	509	68.3	43.5 J	222 J	62.2 J	37.2 J	34.7	46.2 J	89.6 J	28.5 J	50.6 J	70.3 J	92.3 J
LEAD	258	96.7	30	109	67.5	21.8	29	29.6	56.8	15.4	33.7	102	64.8
MERCURY	0.892 J	0.17	0.124	0.159	0.181	0.0442	0.0329 J	0.0652	0.132	0.0289 J	0.171	0.157	0.22
ZINC	2960	384 J	131	1180	224	96.7	107 J	141	329	85.5 J	56.7	299	357

TABLE 3-9

DETECTED CHEMICAL CONCENTRATIONS IN SEDIMENT COMPARED TO MAXIMUM SUSPENDED SEDIMENT CONCENTRATION
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS
PAGE 2 OF 2

SAMPLE ID	Maxi Susp Sedi Concer	NTC17PCSD65	NTC17PCSD66	NTC17PCSD67	NTC17PCSD68	NTC17PCSD69	NTC17PCSD70	NTC17PCSD71	NTC17PCSD72
LOCATION		REF	REF	REF	REF	REF, TRIB	UPSTREAM	UPSTREAM	UPSTREAM
SAMPLE DATE		03/29/12	03/29/12	03/29/12	03/29/12	03/29/12	03/28/12	03/28/12	03/28/12
TOP DEPTH (FEET)		0	0	0	0	0	0	0	0
BOTTOM DEPTH (FEET)		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
POLYNUCLEAR AROMATIC HYDROCARBO									
2-METHYLNAPHTHALENE	0.0357	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.047 U	0.144 U	0.0927 U	0.413
ACENAPHTHENE	0.0808	0.0261 U	0.0622 J	0.054 U	0.0533 U	0.0604 J	0.144 U	0.165 J	1.82
ACENAPHTHYLENE	0.0357	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.047 U	0.144 U	0.0927 U	0.0881 U
ANTHRACENE	0.165	0.0399 J	0.185	0.181	0.0533 U	0.047 U	0.144 U	0.0927 U	2.61
BENZO(A)ANTHRACENE	0.722	0.158	0.684	0.752	0.208	0.99	0.758	1.91	7.14
BENZO(A)PYRENE	0.922	0.17	0.576	0.625	0.218	1.16	1.2	2.62	7.8
BENZO(B)FLUORANTHENE	1.11	0.201	0.683	0.653	0.267	1.32	1.62	2.89	7.08
BENZO(G,H,I)PERYLENE	0.552	0.127	0.328	0.288	0.149	0.737	1.08	2.1	4.63
BENZO(K)FLUORANTHENE	1.02	0.196	0.707	0.645	0.252	1.35	1.18	2.94	8.56
CHRYSENE	1.06	0.254	0.902	0.734	0.292	1.68	1.18	2.81	8.81
DIBENZO(A,H)ANTHRACENE	0.123	0.038 J	0.158	0.0922 J	0.0533 U	0.207	0.144 U	0.689	1.91
FLUORANTHENE	2.38	0.475	1.96	1.86	0.564	3.46	2.16	6.8	21.9
FLUORENE	0.0858	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.0872 J	0.144 U	0.215	1.76
INDENO(1,2,3-CD)PYRENE	0.526	0.107	0.325	0.296	0.124	0.683	0.925	1.9	4.53
NAPHTHALENE	0.0357	0.0261 U	0.0485 U	0.054 U	0.0533 U	0.047 U	0.144 U	0.0927 U	1.6
PHENANTHRENE	1.19	0.197	1.04	0.528	0.23	1.67	0.813	3.38	17.8
PYRENE	1.84	0.386	1.49	1.4	0.448	2.83	1.77	5.3	17.2
TOTAL PAHS	11.8	2.35 J	9.1 J	8.05 J	2.75	16.2 J	12.7	33.7 J	116
PESTICIDES (MG/KG)									
4,4'-DDD	0.0017	0.00608 J	0.0234 J	0.0147 J	0.0254 J	0.0063 J	0.00079 J	0.00087 J	0.00096 J
4,4'-DDE	0.0034	0.00601	0.026	0.0225	0.0323	0.0142	0.00221 J	0.00036 J	0.00037 J
4,4'-DDT	0.0079	0.0008 J	0.00469 J	0.00915 J	0.00414 J	0.00794 J	0.00073 UJ	0.00375 J	0.00414 J
ALDRIN	0.0017	0.00029 J	0.0005 U	0.00051 J	0.00069 J	0.00046 U	0.00073 U	0.00072 J	0.00044 U
ALPHA-CHLORDANE	0.0017	0.00053 U	0.0005 U	0.00169	0.00055 U	0.00046 U	0.00073 U	0.00047 U	0.00044 U
ENDOSULFAN II	0.0047	0.00057 J	0.00205	0.00137	0.00118 J	0.00165 J	0.00224 J	0.00245	0.0025
GAMMA-CHLORDANE	0.0096	0.00318 U	0.00065 U	0.00079 U	0.00192 U	0.00037 U	0.00392 J	0.00263	0.00301 J
TOTAL DDT POS	0.0113	0.0129 J	0.0541 J	0.0464 J	0.0618 J	0.0284 J	0.003 J	0.00498 J	0.00547 J
PCBS (MG/KG)									
AROCLOR-1016	0.0438	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0185 U	0.0118 U	0.011 U
AROCLOR-1221	0.0438	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0185 U	0.0118 U	0.011 U
AROCLOR-1232	0.0438	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0185 U	0.0118 U	0.011 U
AROCLOR-1242	0.0438	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0185 U	0.0118 U	0.011 U
AROCLOR-1248	0.0438	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0185 U	0.0118 U	0.011 U
AROCLOR-1254	0.0438	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0185 U	0.0118 U	0.011 U
AROCLOR-1260	0.334	0.0133 U	0.0125 U	0.0139 U	0.0138 U	0.0117 U	0.0707 J	0.0118 U	0.025 J
METALS (MG/KG)									
ARSENIC	27	6.34	6.91	6.45	6.46	7.59	13.5	5.41	6.73
CADMIUM	1.44	0.808 U	0.725 U	0.805 U	0.0866 J	0.703 U	2.4 J	1.32 J	0.679 U
CHROMIUM	31.9	17.8	17.8	17.7	11	20.7	33.2	22.9	21.3
COPPER	509	26.6	36.8	31	27.4	40.6	390 J	251 J	94.3 J
LEAD	258	24	33.8	25.8	24.6	53.6	220	144	29.7
MERCURY	0.892	0.0654	0.169	0.632	0.203	0.061	0.366	0.96	0.193
ZINC	2960	91.8 J	144 J	104 J	96 J	146 J	1580 J	848	300 J

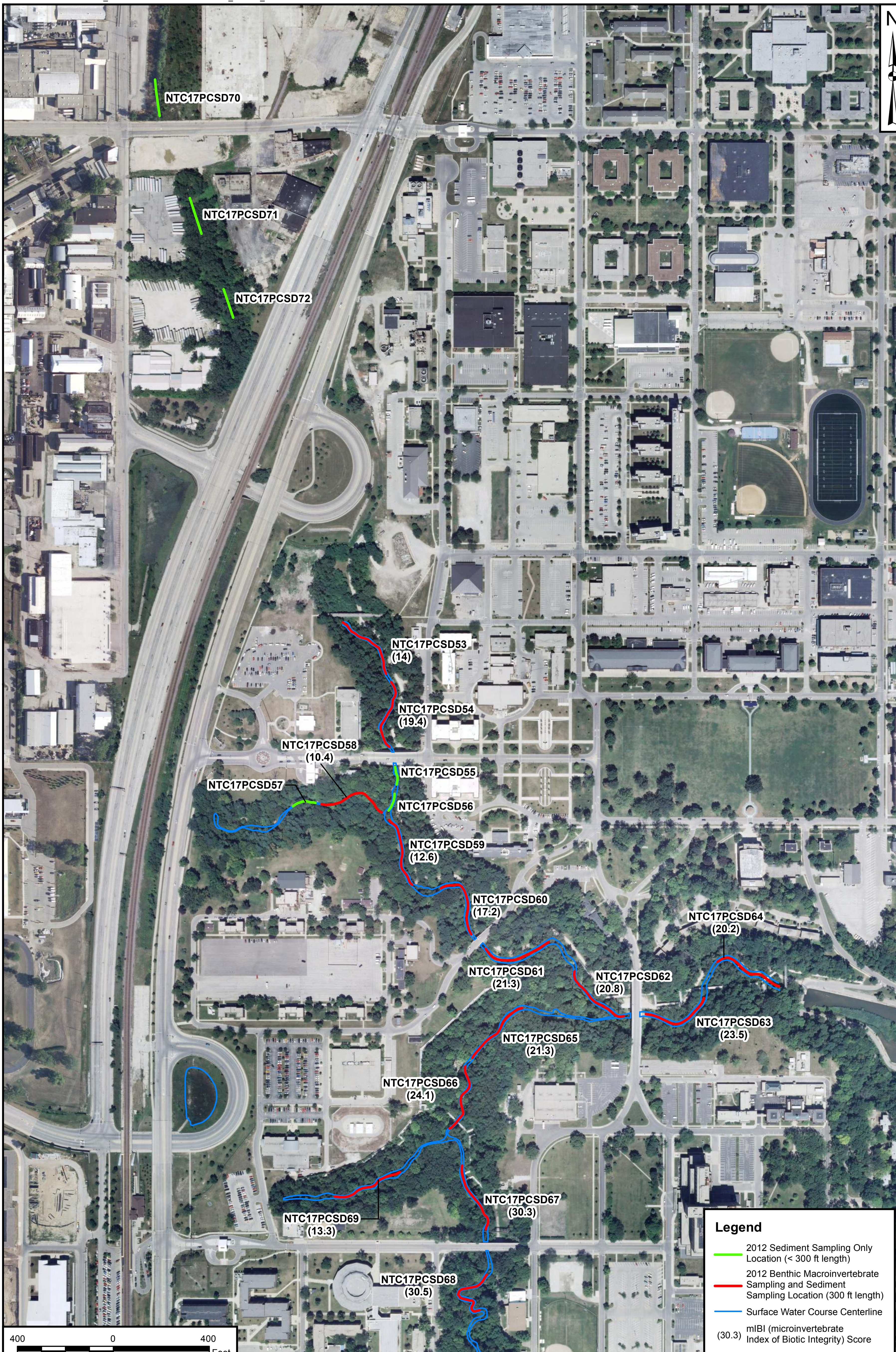
Notes:
Shaded cells indicate an exceedance of the maximum suspended sediment concentration (samples NTC17PCSD50 and NTC17PCSD51-52).

Abbreviations:
J - Estimated value
U - Nondetected result
NA - Not available/Not applicable
TRIB - Tributary
REF - Reference

Sources:

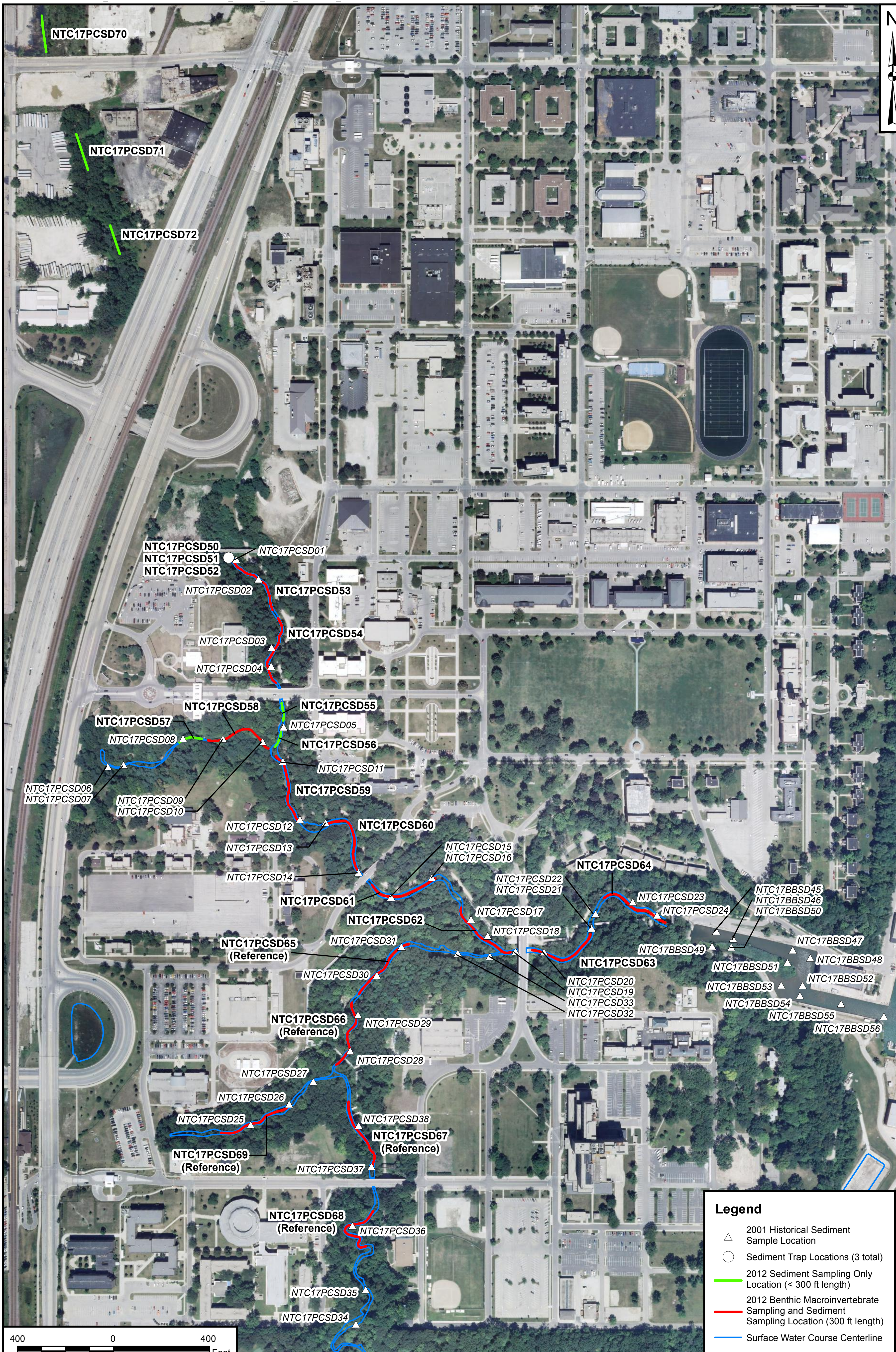
Illinois EPA Tier 1 - Draft Illinois EPA Tiered Approach for Evaluation and Remediation of Petroleum Product Releases to Sediments (Illinois EPA, 2009)
Region 5 – USEPA Region 5 Ecological Screening Levels, Sediment (USEPA, 2003)

PGH P:\GIS\GREATLAKES_NS\MAPDOCS\MXD\PETTIBONE_CREEK_MIBI.MXD 06/11/12 JEE



DRAWN BY J. ENGLISH	DATE 05/23/12	MACROINVERTEBRATE INDEX OF BIOTIC INTEGRITY AT EACH BENTHIC COMMUNITY SAMPLE LOCATION PETTIBONE CREEK NAVAL STATION GREAT LAKES GREAT LAKES, ILLINOIS	CONTRACT NUMBER 1021 / CTO NUMBER 474
CHECKED BY A. BERNHARDT	DATE 06/11/12		APPROVED BY — / DATE —
REVISED BY —	DATE —		APPROVED BY — / DATE —
SCALE AS NOTED		NAVFAC	FIGURE NO. FIGURE 3-1 / REV 0

PGH P:\GIS\GREATLAKES_NS\MAPDOCS\MXD\PETTIBONE_CREEK_LINEAR_REACHES_REV.MXD 05/25/12 JEE



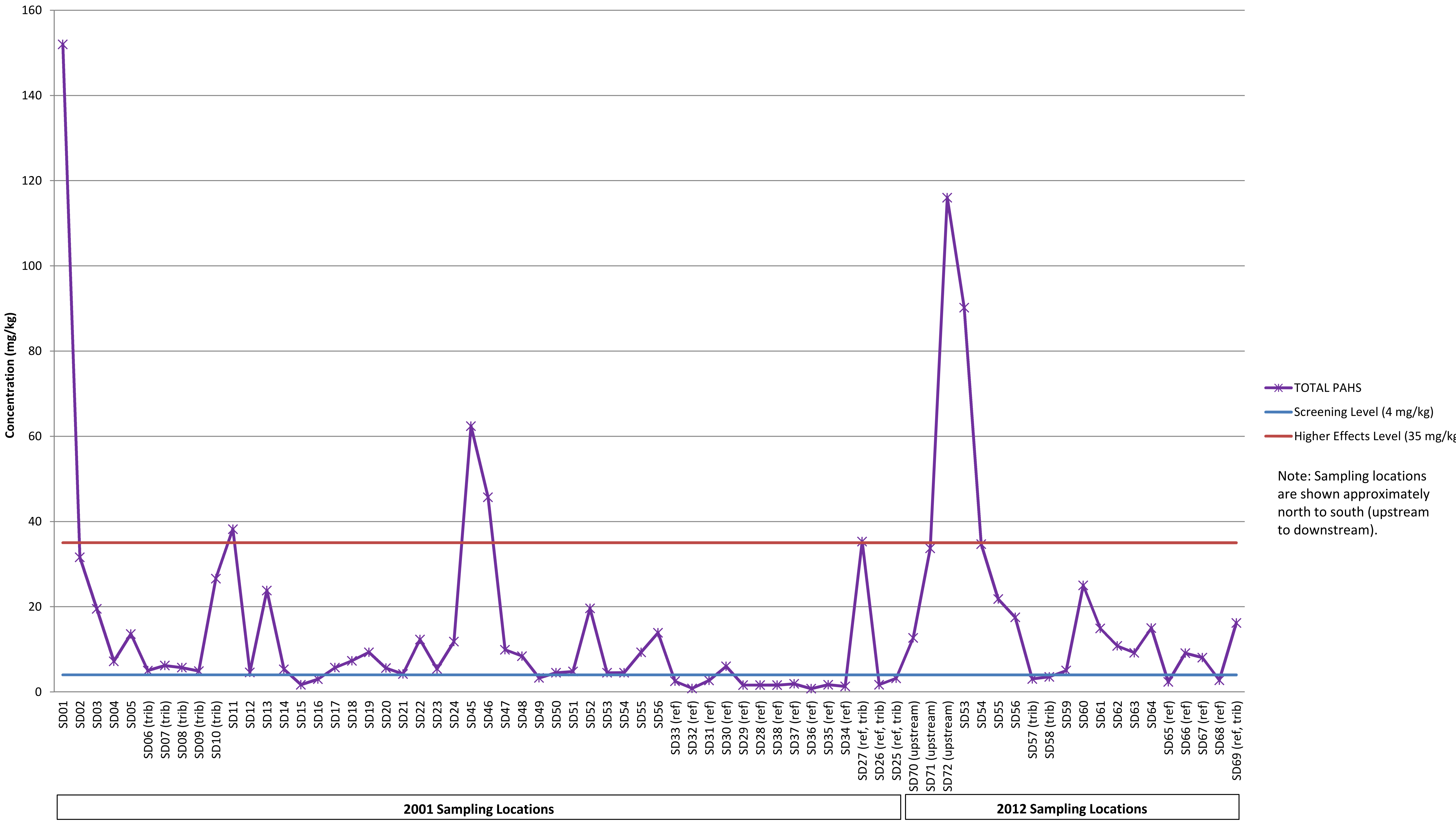
DRAWN BY	DATE
J. ENGLISH	05/25/12
CHECKED BY	DATE
L. GANSER	05/25/12
REVISED BY	DATE
—	—
SCALE	
AS NOTED	

NAVFAC

CURRENT AND HISTORICAL SAMPLING LOCATIONS
PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NUMBER	CTO NUMBER
1021	474
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO. FIGURE 3-2	REV 0

Figure 3-3
Total PAH Concentrations at 2001 and 2012 Sampling Locations



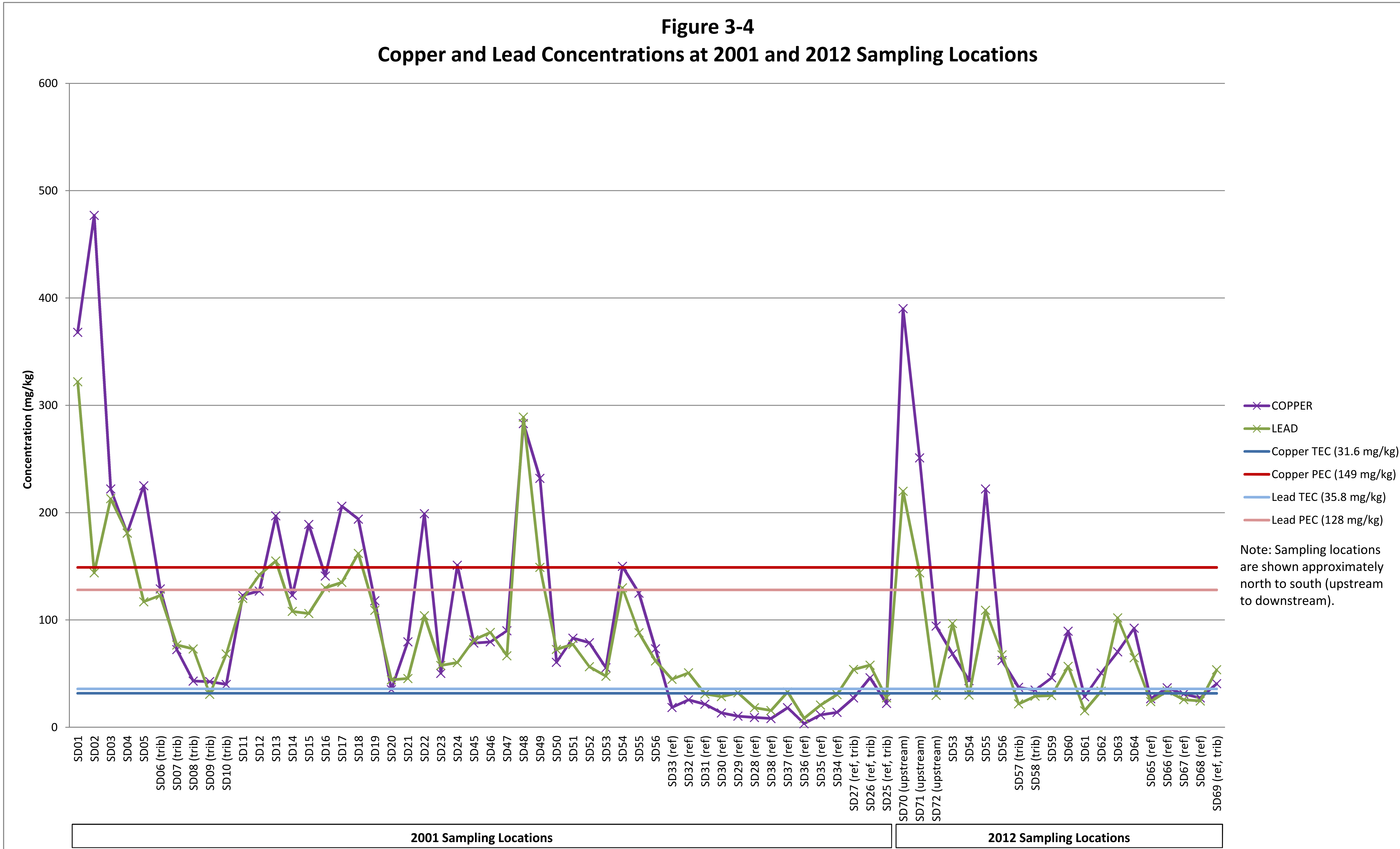


Figure 3-4
Copper and Lead Concentrations at 2001 and 2012 Sampling Locations
Concentration (mg/kg)
600
500
400
300
200
100
0
SD01
SD02
SD03
SD04
SD05
SD06 (trib)
SD07 (trib)
SD08 (trib)
SD09 (trib)
SD10 (trib)
SD11
SD12
SD13
SD14
SD15
SD16
SD17
SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD45
SD46
SD47
SD48
SD49
SD50
SD51
SD52
SD53
SD54
SD55
SD56
SD33 (ref)
SD32 (ref)
SD31 (ref)
SD30 (ref)
SD29 (ref)
SD28 (ref)
SD38 (ref)
SD37 (ref)
SD36 (ref)
SD35 (ref)
SD34 (ref)
SD27 (ref, trib)
SD26 (ref, trib)
SD25 (ref, trib)
SD70 (upstream)
SD71 (upstream)
SD72 (upstream)
SD53
SD54
SD55
SD56
SD57 (trib)
SD58 (trib)
SD59
SD60
SD61
SD62
SD63
SD64
SD65 (ref)
SD66 (ref)
SD67 (ref)
SD68 (ref)
SD69 (ref, trib)
2001 Sampling Locations
2012 Sampling Locations
COPPER
LEAD
Copper TEC (31.6 mg/kg)
Copper PEC (149 mg/kg)
Lead TEC (35.8 mg/kg)
Lead PEC (128 mg/kg)
Note: Sampling locations are shown approximately north to south (upstream to downstream).

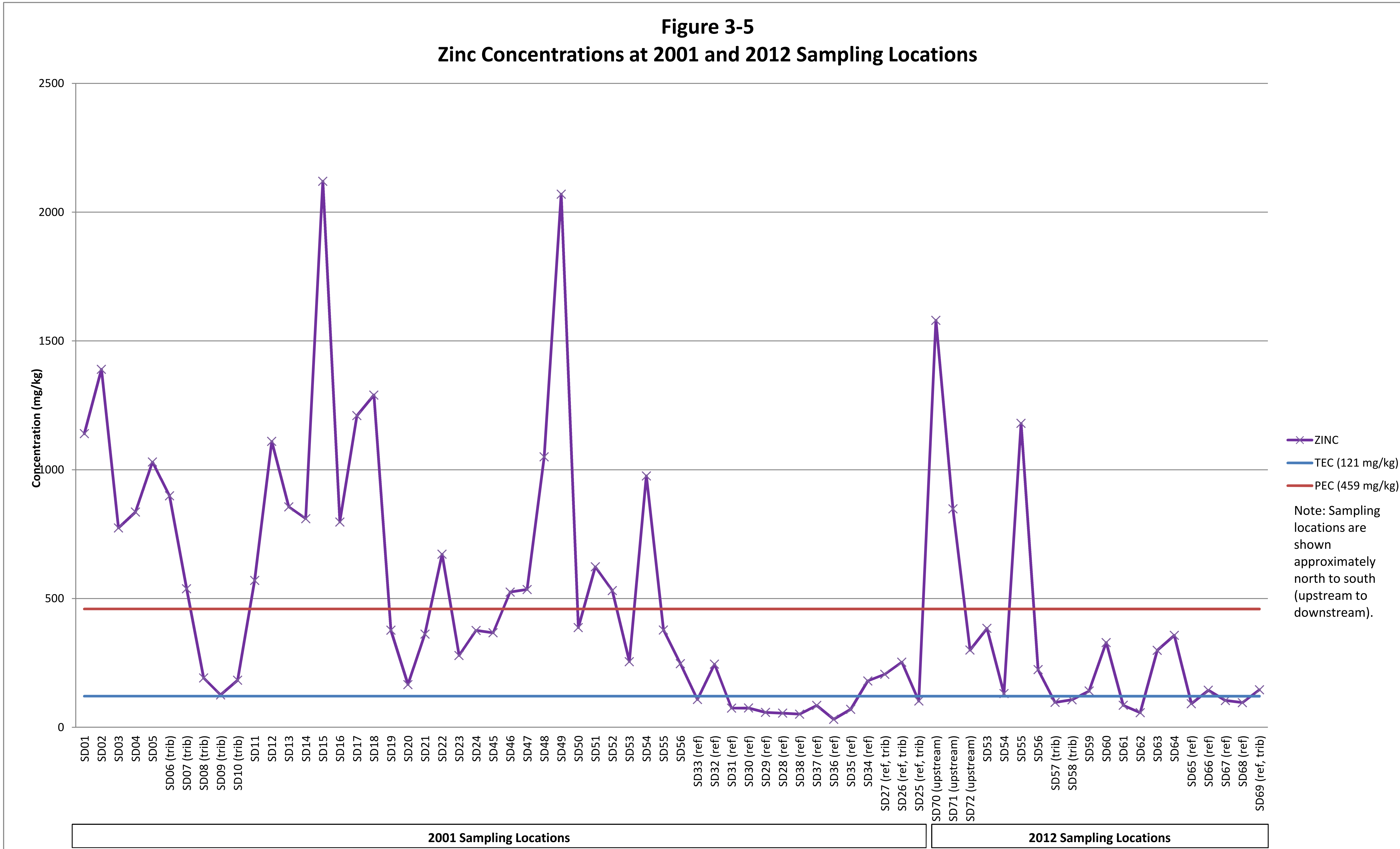


Figure 3-5
Zinc Concentrations at 2001 and 2012 Sampling Locations
Concentration (mg/kg)
2500
2000
1500
1000
500
0
ZINC
TEC (121 mg/kg)
PEC (459 mg/kg)
Note: Sampling locations are shown approximately north to south (upstream to downstream).
SD01
SD02
SD03
SD04
SD05
SD06 (trib)
SD07 (trib)
SD08 (trib)
SD09 (trib)
SD10 (trib)
SD11
SD12
SD13
SD14
SD15
SD16
SD17
SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD45
SD46
SD47
SD48
SD49
SD50
SD51
SD52
SD53
SD54
SD55
SD56
SD33 (ref)
SD32 (ref)
SD31 (ref)
SD30 (ref)
SD29 (ref)
SD28 (ref)
SD38 (ref)
SD37 (ref)
SD36 (ref)
SD35 (ref)
SD34 (ref)
SD27 (ref, trib)
SD26 (ref, trib)
SD25 (ref, trib)
SD70 (upstream)
SD71 (upstream)
SD72 (upstream)
SD53
SD54
SD55
SD56
SD57 (trib)
SD58 (trib)
SD59
SD60
SD61
SD62
SD63
SD64
SD65 (ref)
SD66 (ref)
SD67 (ref)
SD68 (ref)
SD69 (ref, trib)
2001 Sampling Locations
2012 Sampling Locations

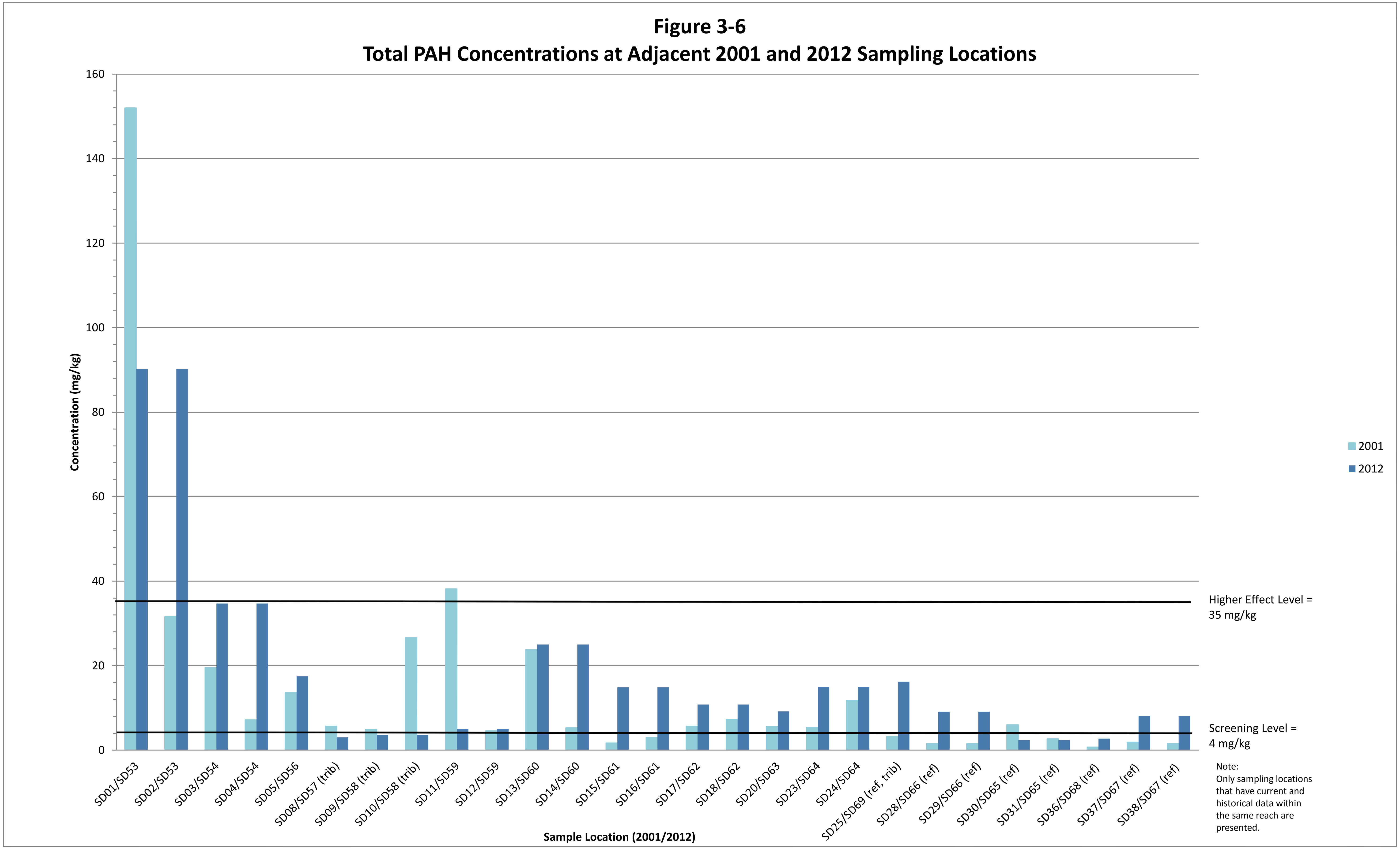


Figure 3-6
Total PAH Concentrations at Adjacent 2001 and 2012 Sampling Locations
Concentration (mg/kg)
160
140
120
100
80
60
40
20
0
SD01/SD53
SD02/SD53
SD03/SD54
SD04/SD54
SD05/SD56
SD08/SD57 (trib)
SD09/SD58 (trib)
SD10/SD58 (trib)
SD11/SD59
SD12/SD59
SD13/SD60
SD14/SD60
SD15/SD61
SD16/SD61
SD17/SD62
SD18/SD62
SD20/SD63
SD23/SD64
SD24/SD64
SD25/SD69 (ref, trib)
SD28/SD66 (ref)
SD29/SD66 (ref)
SD30/SD65 (ref)
SD31/SD65 (ref)
SD36/SD68 (ref)
SD37/SD67 (ref)
SD38/SD67 (ref)
Sample Location (2001/2012)
2001
2012
Higher Effect Level = 35 mg/kg
Screening Level = 4 mg/kg
Note:
Only sampling locations that have current and historical data within the same reach are presented.

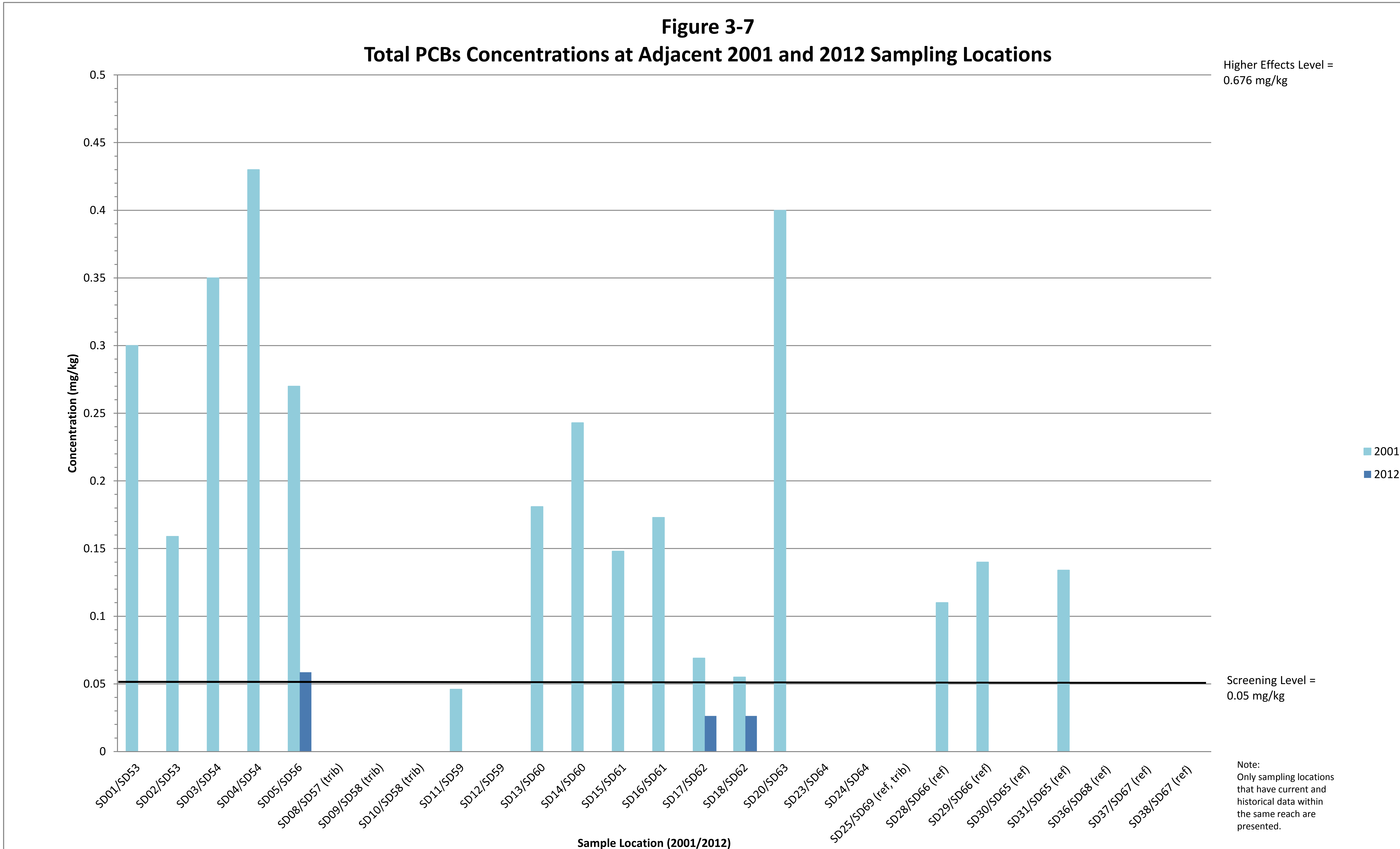


Figure 3-7
Total PCBs Concentrations at Adjacent 2001 and 2012 Sampling Locations
Higher Effects Level =
0.676 mg/kg
Screening Level =
0.05 mg/kg
Concentration (mg/kg)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2001
2012
SD01/SD53
SD02/SD53
SD03/SD54
SD04/SD54
SD05/SD56
SD08/SD57 (trib)
SD09/SD58 (trib)
SD10/SD58 (trib)
SD11/SD59
SD12/SD59
SD13/SD60
SD14/SD60
SD15/SD61
SD16/SD61
SD17/SD62
SD18/SD62
SD20/SD63
SD23/SD64
SD24/SD64
SD25/SD69 (ref, trib)
SD28/SD66 (ref)
SD29/SD66 (ref)
SD30/SD65 (ref)
SD31/SD65 (ref)
SD36/SD68 (ref)
SD37/SD67 (ref)
SD38/SD67 (ref)
Sample Location (2001/2012)
Note:
Only sampling locations that have current and historical data within the same reach are presented.

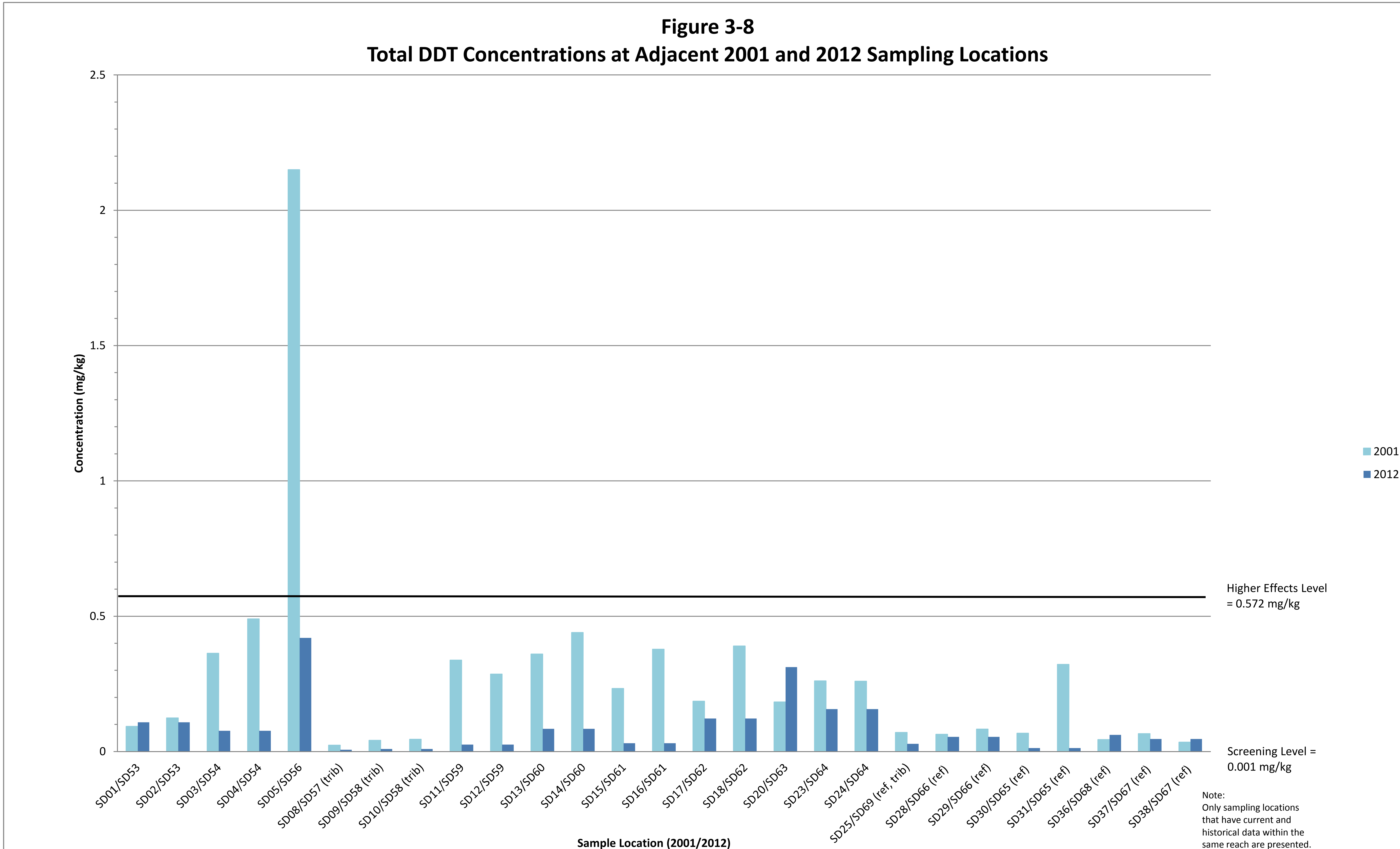


Figure 3-8
Total DDT Concentrations at Adjacent 2001 and 2012 Sampling Locations
Concentration (mg/kg)
2.5
2
1.5
1
0.5
0
Higher Effects Level = 0.572 mg/kg
Screening Level = 0.001 mg/kg
2001
2012
SD01/SD53
SD02/SD53
SD03/SD54
SD04/SD54
SD05/SD56
SD08/SD57 (trib)
SD09/SD58 (trib)
SD10/SD58 (trib)
SD11/SD59
SD12/SD59
SD13/SD60
SD14/SD60
SD15/SD61
SD16/SD61
SD17/SD62
SD18/SD62
SD20/SD63
SD23/SD64
SD24/SD64
SD25/SD69 (ref, trib)
SD28/SD66 (ref)
SD29/SD66 (ref)
SD30/SD65 (ref)
SD31/SD65 (ref)
SD36/SD68 (ref)
SD37/SD67 (ref)
SD38/SD67 (ref)
Sample Location (2001/2012)
Note:
Only sampling locations that have current and historical data within the same reach are presented.

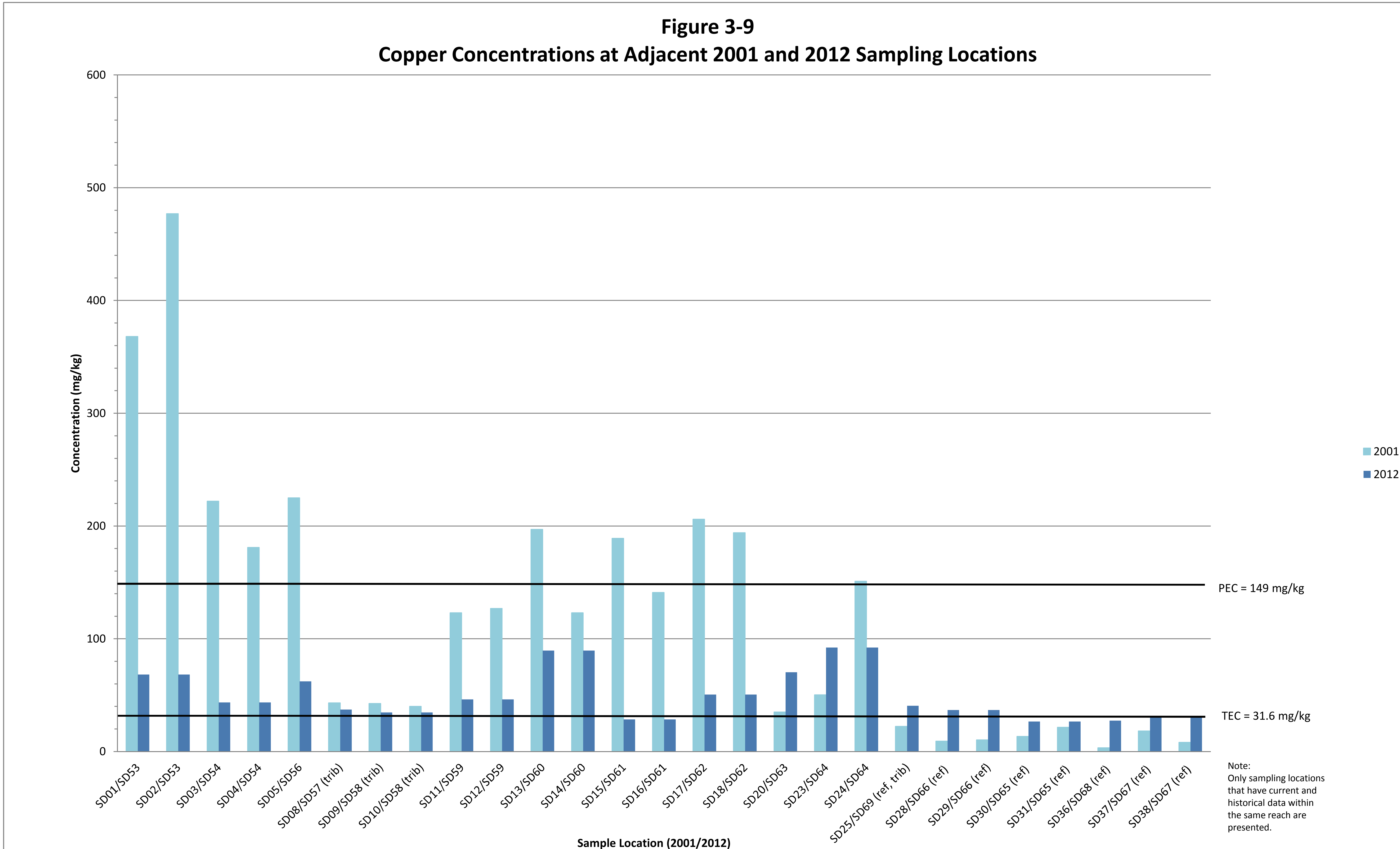
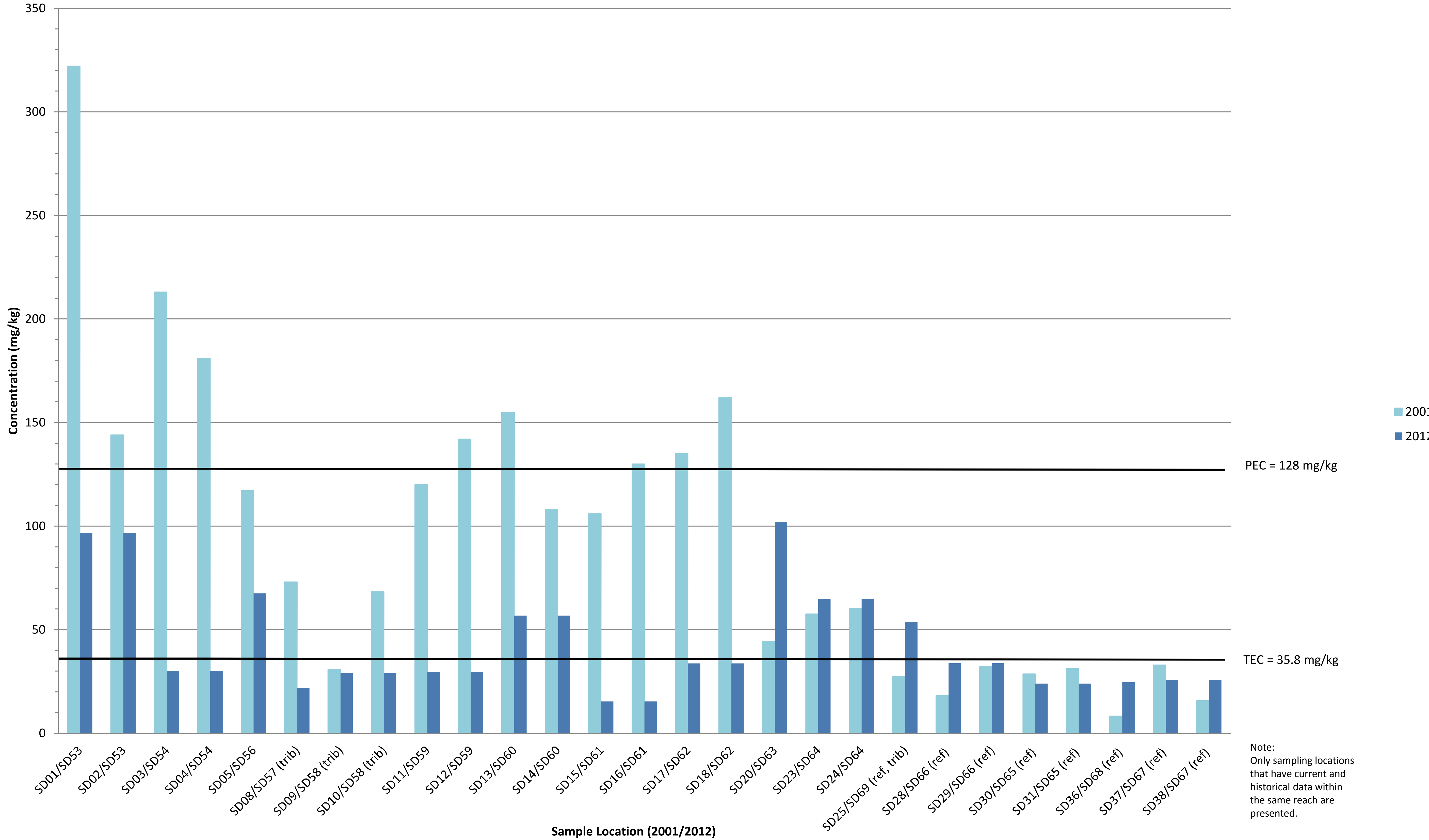


Figure 3-9
Copper Concentrations at Adjacent 2001 and 2012 Sampling Locations
Concentration (mg/kg)
600
500
400
300
200
100
0
PEC = 149 mg/kg
TEC = 31.6 mg/kg
2001
2012
SD01/SD53
SD02/SD53
SD03/SD54
SD04/SD54
SD05/SD56
SD08/SD57 (trib)
SD09/SD58 (trib)
SD10/SD58 (trib)
SD11/SD59
SD12/SD59
SD13/SD60
SD14/SD60
SD15/SD61
SD16/SD61
SD17/SD62
SD18/SD62
SD20/SD63
SD23/SD64
SD24/SD64
SD25/SD69 (ref, trib)
SD28/SD66 (ref)
SD29/SD66 (ref)
SD30/SD65 (ref)
SD31/SD65 (ref)
SD36/SD68 (ref)
SD37/SD67 (ref)
SD38/SD67 (ref)
Sample Location (2001/2012)
Note:
Only sampling locations that have current and historical data within the same reach are presented.

Figure 3-10
Lead Concentrations at Adjacent 2001 and 2012 Sampling Locations



Note:
Only sampling locations that have current and historical data within the same reach are presented.

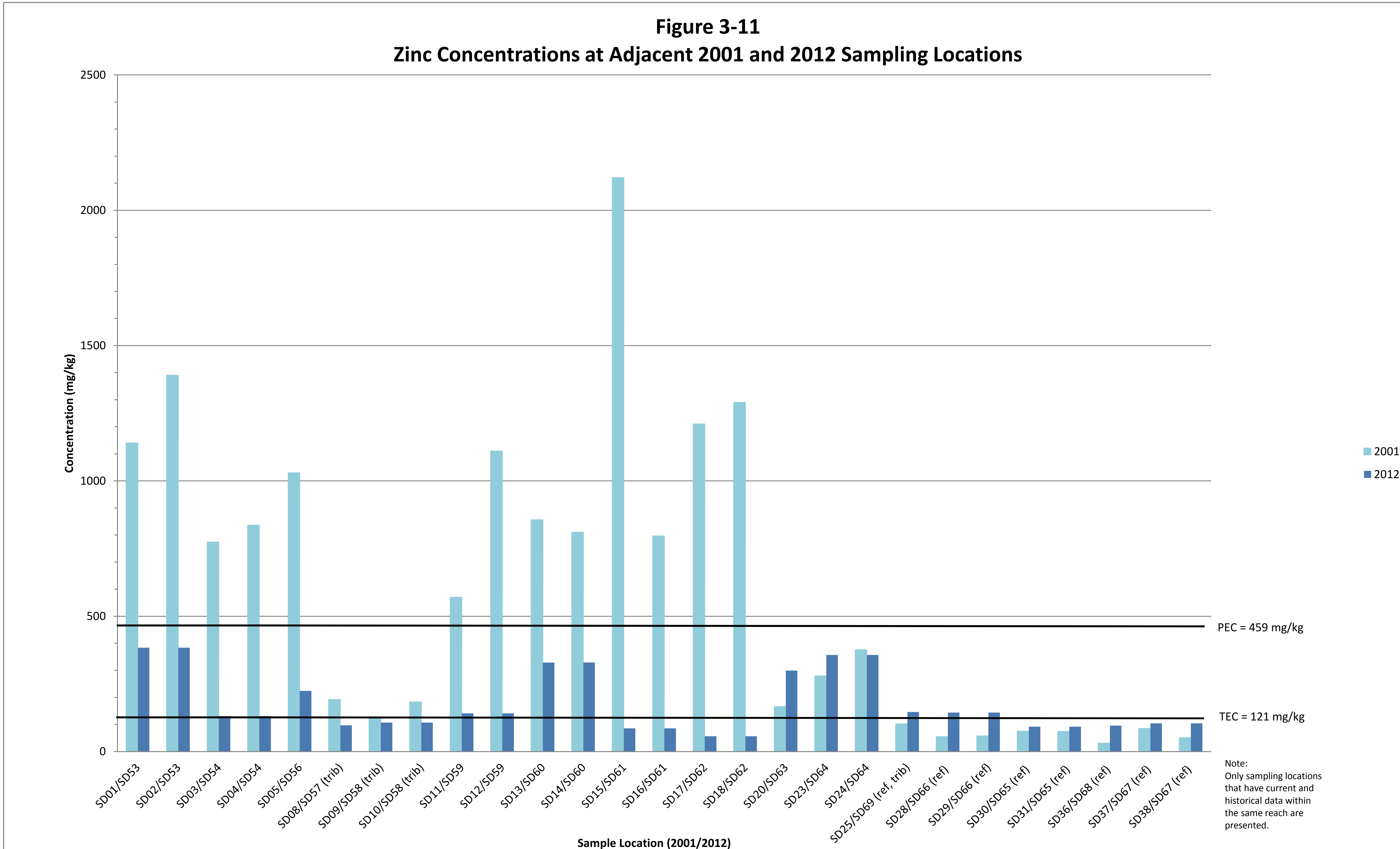


Figure 3-11
Zinc Concentrations at Adjacent 2001 and 2012 Sampling Locations
Concentration (mg/kg)
2500
2000
1500
1000
500
0
2001
2012
PEC = 459 mg/kg
TEC = 121 mg/kg
SD01/SD53
SD02/SD53
SD03/SD54
SD04/SD54
SD05/SD56
SD08/SD57 (trib)
SD09/SD58 (trib)
SD10/SD58 (trib)
SD11/SD59
SD12/SD59
SD13/SD60
SD14/SD60
SD15/SD61
SD16/SD61
SD17/SD62
SD18/SD62
SD20/SD63
SD23/SD64
SD24/SD64
SD25/SD69 (ref, trib)
SD28/SD66 (ref)
SD29/SD66 (ref)
SD30/SD65 (ref)
SD31/SD65 (ref)
SD36/SD68 (ref)
SD37/SD67 (ref)
SD38/SD67 (ref)
Sample Location (2001/2012)
Note:
Only sampling locations that have current and historical data within the same reach are presented.

4.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

4.1 SUMMARY/CONCLUSIONS

The recent sampling event was conducted in March 2012 and consisted of collecting benthic invertebrates to assess benthic community health, surficial and suspended sediment samples for chemical analysis, and surficial sediment samples for toxicity testing. The investigation was conducted to determine: whether benthic invertebrates are adversely impacted from exposure to North Branch Pettibone Creek sediment; the current sediment quality in Pettibone Creek; and whether a continuing source of sediment contamination persists upstream of Navy property.

4.1.1 <u>Benthic Community Evaluation</u>

This section presents the evaluation of the benthic community including the benthic community survey, the sediment chemistry, and the toxicity testing.

4.1.1.1 Benthic Community Survey

Benthic invertebrates were collected to characterize the current benthic community present within Pettibone Creek. In addition to collecting the benthic samples, a physical habitat assessment was also conducted to help interpret the results.

The primary metric that was used to evaluate the health of the benthic invertebrate community in Pettibone Creek was the mIBI. The samples had mIBI scores indicating biologically degraded conditions, with assessment ratings of “Fair” and “Poor.” However, samples were collected outside of the index period specified by Illinois EPA for the use of these rankings. If the samples had been collected during the index period, the scores may be higher because some insect taxa not identified in March would have grown and be identified in summer samples. Although an increase in insect taxa would probably have resulted in higher mIBI scores, the mIBI index is still useful for comparing scores between the reference samples and the site samples. In general, the Pettibone Creek reference mIBI scores were in the “Fair” assessment category and site index values were rated as “Poor”; however, there was some crossover. The test sites with scores in the “Fair” range were in the downstream portions of the channel (Figure 3-1). For other metrics, averages from reference sample sites were consistently higher than the average of test site sample scores.

Stream habitat conditions which were characterized using the QHEI, were relatively consistent among sites, with QHEI scores ranging from 52 to 66 at reference sample sites, and 49.5 to 61 at test sample sites. Most of the reference sites had QHEI scores in the “Good” range, as did many of the test sites;

most of the test sites which were classified in the “Good” range were located in the downstream portions of the North Branch. The biological index and the QHEI were highly correlated, with the regression coefficient (r^2 = 0.48) suggesting that 48% of the variability in the biological index can be attributed to the QHEI and 52% of the variability is due to other factors.

4.1.1.2 Surficial Sediment

Surficial sediment samples from 0 to 4 cm were collected from Pettibone Creek for chemical analysis. Maximum concentrations of metals and PCBs were generally detected in an upstream sample located near former manufacturing facilities. Maximum concentrations of PAHs were detected in upstream sample located immediately downstream of a storm sewer collecting water/runoff from a large section of the City of North Chicago. These results suggest that upstream sources are currently contributing to the chemical concentrations detected downstream in Pettibone Creek.

The concentrations of the detected chemicals were compared to various sediment criteria to determine whether the concentrations exceeded the criteria and have the potential to impact benthic invertebrates. Based on these comparisons, copper, lead, zinc, and PAHs have the greatest probability of impacting sediment invertebrates. Individual PAHs exceeded screening levels in several samples, and concentrations of total PAHs exceeded the screening level in most samples. Five samples (two upstream and three site samples) had total PAH concentrations exceeding the alternative sediment cleanup objective of 23 mg/kg. Several metals were detected at concentrations that exceeded their screening criteria, but most of the concentrations were less than the PEC, with the exception of two upstream locations, and one site sample (from location NTC17PCSD55). The sample from NTC17PCSD55 had the greatest concentrations of several metals (copper, lead, and zinc) in any of the site samples. Although the benthic community survey and toxicity testing results from this reach would be valuable to consider, the reach is only 100 feet long, representing a small portion of Pettibone Creek.

Although concentrations of PCBs and pesticides exceeded their respective screening levels in several samples, concentrations were much lower than their respective PECs. Also, concentrations of several pesticides were relatively low and are indicative of typical spraying activities. Therefore, impacts to benthic invertebrates from PCBs and pesticides are not likely.

Chemical concentrations in the site samples were generally greater than concentrations in reference samples. However, chemicals concentrations from the North Branch tributary (NTC17PCSD57 and NTC17PCSD58), NTC17PCSD59, NTC17PCSD62, and NTC17PCSD63 were similar to reference samples concentrations for total PAHs. Chemical concentrations from the North Branch tributary (NTC17PCSD57 and NTC17PCSD58), NTC17PCSD54, NTC17PCSD59, NTC17PCSD61, and

NTC17PCSD62 were generally similar to reference samples concentrations for the primary metals of concern (copper, lead, and zinc).

Current sediment concentrations are generally lower compared to historical sediment samples collected in 2001, with the exception of PAHs. Concentrations of PAHs and metals have increased slightly in some reference samples and at locations downstream of the confluence of North and South Branches of Pettibone Creek.

4.1.1.3 Toxicity Testing

10-day sediment toxicity testing using *H. azteca* was performed to help assess risks to sediment invertebrates, and to develop cleanup goals (if needed). The tests were conducted on one laboratory control sample, two reference samples (South Branch of Pettibone Creek), and six site samples. The toxicity testing indicated acceptable survival for the site and reference samples. Mean growth in some of the site samples was significantly lower than the mean growth in one reference sample (NTC17PCSD66). However, this reference sample had much greater growth compared to the other reference sample (NTC17PCSD68). Tables C-2 and C-3 in Appendix E show which samples had lower growth compared to the growth in sample NTC17PCSD66. None of the site samples had significantly lower mean growth compared to the mean growth in the reference sample from NTC17PCSD68. Therefore, growth is not considered impacted in site samples.

4.1.1.4 Overall Benthic Invertebrate Community Evaluation

Three lines of evidence were used to determine whether the benthic community was being impacted in Pettibone Creek and, if so, whether the impacts were related to the chemicals in the sediment. Table 3-6 presents the results of these three lines of evidence. The first line of evidence, the benthic community survey, found that the benthic community in Pettibone Creek ranged from poor to fair, although in general, the benthic communities in the reference reaches were better than those in the site reaches. There was a strong correlation between the benthic community health and the habitat conditions. The next line of evidence was sediment chemistry. Several chemicals were detected at concentrations that exceeded their respective screening levels. Among these chemicals, copper, lead, zinc, and total PAHs have the highest probability of impacting sediment invertebrates. In general, concentrations of contaminants (primarily PAHs and metals such as copper, lead, and zinc) are generally higher in the North Branch of Pettibone Creek (site reaches) compared to the South Branch (reference reaches). However, there does not appear to be a correlation between chemical concentrations in the sediment and any of the benthic macroinvertebrate metrics, which indicates that sediment chemistry may not be the reason for the “poor” to “fair” benthic community health ratings. Finally, the last line of evidence, toxicity testing, found that none of the site samples were considered impacted regarding the survival or growth of

H. azteca. Based on the results of these three lines of evidence, the possibility that chemicals in the sediment are at least partially impacting the benthic community in Pettibone Creek cannot be ruled out. However, the lack of toxicity observed in the toxicity test supports the likelihood that the poor to fair benthic community in the creek is related to the habitat, along with the timing of the sampling which was outside the Illinois EPA mIBI index period. This is further supported by the plots that were prepared to evaluate the relationship between chemical concentrations and benthic community of the toxicity test results. No strong relationships were found on the plots.

4.1.2 <u>Upstream Continuing Sediment Contamination Source</u>

To determine whether there is a continuing upstream source of contamination to Pettibone Creek, surficial sediment samples were collected from three locations in Pettibone Creek upstream of where the creek enters NSGL, and two suspended sediment samples were collected from sediment traps at the point where Pettibone Creek enters the NSGL property boundary.

4.1.2.1 Upstream Surficial Sediment Samples

Three surficial sediment samples (NTC17PCSD70, NTC17PCSD71, and NTC17PCSD72) were collected in Pettibone Creek, upstream of NSGL property (see Figure 3-2). With the exception of a few pesticides, all of the maximum detected concentrations were in the upstream sediment samples.

Maximum concentrations of metals and PCBs were generally detected in the farthest upstream sampling location (NTC17PCSD70). Although the elevated metal concentrations are likely reflective of the manufacturing facilities that existed in this area, it is not known whether the concentrations in the sediment represent historical discharges, or whether there are current sources of metals that are still discharging to Pettibone Creek. It is possible that the upstream sediment is a continuing source of contamination to the downstream portion of Pettibone Creek; however, the current source of metals contamination to the creek has likely decreased.

Maximum concentrations of PAHs were detected in the sampling location NTC17PCSD72, which is located immediately downstream of a storm sewer collecting water/runoff from a large section of the City of North Chicago. It is likely that upstream sources are continuing to contribute to the elevated PAHs concentrations detected in Pettibone Creek downstream of where the creek enters the NSGL property.

Based on the low concentrations of the pesticides, and the relatively consistent results within Pettibone Creek, it is difficult to determine the source of the pesticides. Potential sources include runoff from areas where pesticides were applies to the ground, which then entered the stormwater system and discharged to Pettibone Creek through the outfalls.

4.1.2.2 Suspended Sediment Samples

Suspended sediment was collected in sediment traps placed in the culverts that discharge the North Branch of Pettibone Creek onto NSGL. The suspended sediment was used to determine the chemical concentrations in sediment flowing onto Navy property over time.

The sample (NTC17PCSD51-52) collected from culverts that carry Pettibone Creek under the highway interchange and receive stormwater drainage from the former manufacturing facilities area and northern part of NSGL had higher metals concentrations compared to all site and reference samples. PAH, pesticide, and PCB data were only available from sample NTC17PCSD50. Several PAH and pesticide concentrations were lower in the suspended sediment sample compared to several upstream (NTC17PCSD70 through NTC17PCSD72), site (NTC17PCSD53 through NTC17PCSD56, NTC17PCSD60, NTC17PCSD61, and NTC17PCSD64), and reference (NTC17PCSD69) locations. PCB data was higher in the suspended sediment sample compared to all locations. The chemical concentrations detected in the suspended sediment samples may be biased high due to the smaller grain size collected by sediment traps compared to the grab sediment samples. However, the elevated metal concentrations in sample NTC17PCSD51-52 are likely reflective of the former manufacturing facilities that existed upstream of Navy property. The suspended sediment results suggest that upstream sources are continuing to contribute to the chemical concentrations detected in Pettibone Creek downstream of where the creek enters the NSGL property.

4.1.2.3 Overall Conclusions - Upstream Continuing Sediment Contamination Source

Based on elevated chemical concentrations, particularly metals and PAH concentrations, in upstream sediment samples and suspended sediment samples, upstream sources are continuing to contribute to the chemical concentrations detected in Pettibone Creek downstream of where the creek enters the NSGL property.

4.2 RECOMMENDATIONS

Based on the results of this investigation, no actions are recommended for Pettibone Creek because a combination of available habitat, physical stressors related to stream velocities, and sediment chemistry may contribute to the poor benthic communities observed in some of the North Branch samples. However, removal of contaminated sediment would not likely result in a significant benthic community in Pettibone Creek for reasons discussed below because there appears to still be current sources of contamination to Pettibone Creek. This recommendation only applies to the portion of Site 17 evaluated in this investigation which is the North Branch of Pettibone Creek that lies within the NSGL property boundary, exclusive of the Boat Basin.

While restoration activity in the North Branch of Pettibone Creek could include removal of contaminated sediment and replacement with clean substrate, removal of contaminated sediment alone is not likely to have a great effect towards restoring biological integrity. That is because it is evident that physical habitat conditions are at least partially limiting biological potential. However, one relatively simple step that could be taken to improve habitat conditions and channel morphology would be to refrain from removing woody debris that falls into the stream channel and along the banks. The woody debris also increases habitat complexity and provides stable, inhabitable substrate for specialized macroinvertebrates, including serving as a nutritional source for some. Additionally, the repair or re-routing of the stormwater outfalls that empty into the creek on base would help improve habitat in the creek. In any case, the physical, chemical, biological, and political goals for restoration should be carefully coordinated and measures to gage eventual project success should be established as restoration activities are planned (Palmer et al., 2005; Palmer, 2008).

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APPENDIX A

SUPPORTING DOCUMENTS FOR FIELD ACTIVITIES AND SITE PHOTOGRAPHS

SUPPORTING DOCUMENTS FOR FIELD ACTIVITIES

Tetra Tech, Inc. | Biological Research Facility

CHAIN-OF-CUSTODY RECORD

Project Manager or Client Contact: SAM STRIBLING TT

Address/Phone: 400 RED BROOK BLVD, SUITE 200 OWINGS MILLS, MD 21117 410-356-8993

Contact Name/Phone: TODD ASKEGAARD

Project Number: 112G01021 | Project Name: NAVFACS

Page 1 of 1 | Sample Location: GREAT LAKES

Type of Analyses Requested

Date	Time	Sample Identification/Station	Preservative (Y/N)	Number of Containers	BENTHIC							
03/28	0930	NTC17PCSD61 - PETTIBONE CREEK	Y	2	✓							
03/28	~~1100~~ 1030	NTC17PCSD60 - "	Y	3	✓							
03/28	1315	NTC17PCSD59 - "	Y	2	✓							
03/28	1430	NTC17PCSD54 - "	Y	3	✓							
03/28	1600	NTC17PCSD53 - "	Y	2	✓							
03/29	0815	NTC17PCSD58 - U.T. TO PETTIBONE CREEK	Y	3	✓							
~~03/29~~	~~1130~~	~~NTC17PCSD64 - UT TO S. BRANCH PETTIBONE CR.~~	~~Y~~	~~3~~								

CB 03/29

[redacted]

Sampled by: (signature)	Date/Time:	Relinquished by: (signature)	Date/Time:	Received by: (signature)	Date/Time:
	03-30-2012 0800		03-30-2012 0800		31-Mar-12 1200
Received by: (signature)	Date/Time:	Received by: (signature)	Date/Time:	Received by: (signature)	Date/Time:

FORM DISTRIBUTION: White - Tt BRF Yellow - Report Pink - Sampler

Tetra Tech, Inc. | Biological Research Facility

CHAIN-OF-CUSTODY RECORD

Project Manager or Client Contact: [illegible] STRIBLING
TETRA TECH INC.

Address/Phone: 400 [illegible] BROOK BLVD.
SUITE 200
OWINGS MILLS, MD

Contact Name/Phone: 410-35[illegible]-[illegible]993

Project Number: 112G01021

Project Name: NAVFACS

Page 1 of 1

Sample Location: GREAT LAKES

Date	Time	Sample Identification/Station	Preservative (Y/N)	Number of Containers	Type of Analyses Requested: BENTHIC								[redacted]
03/29	1130	NTC17PCSD66- S. BRANCH PETTIBONE CR	Y	2	✓								
03/29	1009	NTC17PCSD65- "	Y	2	✓								
03/29	1350	NTC17PCSD69 -UT TO S. BRANCH PETTIBONE CR	Y	3	✓								
03/29	1510	NTC17PCSD67- S. BRANCH PETTIBONE CR	Y	2	✓								
03/29	1615	NTC17PCSD68- "	Y	3	✓								

Sampled by: *(signature)* [signature]	Date/Time: 03-30-12 0800	Relinquished by: *(signature)* [signature]	Date/Time: 03-30-2012 0800	Received by: *(signature)* [signature]	Date/Time: 31 Mar 12 1400
Received by: *(signature)*	Date/Time:	Received by: *(signature)*	Date/Time:	Received by: *(signature)*	Date/Time:

FORM DISTRIBUTION: White - Tt BRF Yellow - Report Pink - Sampler

Tetra Tech, Inc. | Biological Research Facility

CHAIN-OF-CUSTODY RECORD

Project Manager or Client Contact: SAM STRIBLING, TT

Address/Phone: 400 RED BROOK BLVD. SUITE 200 OWINGS MILLS, MD 21117 410-356-8993

Contact Name/Phone: TODD ARNEGAARD

Project Number: 112G01021 | Project Name: NAVFAC

Page of | Sample Location: GREAT LAKES

Type of Analyses Requested

Shaded area for Tt use only

Sample check-in:
DO
pH
Cond/Salinity
Ammonia
Chlorine
Alkalinity
Hardness
Acceptable

Date	Time	Sample Identification/Station	Preservative (Y/N)	Number of Containers	BENTHIC							Collection Method	Log Number
03/27	1500	NTC17PCSD63	Y	3	✓								
03/27	1430	NTC17PCSD64	Y	4	✓								
03/27	1630	NTC17PCSD62	Y	3	✓								

Sampled by: *(signature)*	Date/Time:	Relinquished by: *(signature)*	Date/Time:	Received by: *(signature)*	Date/Time:
[signature]	0800 03-30-2012	[signature]	0800 03-30-2012	[signature]	31Mar12 1700
Received by: *(signature)*	Date/Time:	Received by: *(signature)*	Date/Time:	Received by: *(signature)*	Date/Time:

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TETRA TECH NUS, INC. CTO 474

CHAIN OF CUSTODY

NUMBER № 027878

PAGE 1 **OF** 3

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G01021	GREAT NAVAL STATION LAKES	BOB DAVIS	412 921 7251	EMPIRICAL, B. RICHARD
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
[signature]		KEITH SIMPSON	412 352 2264	
		CARRIER/WAYBILL NUMBER		CITY, STATE
		FEDEX 8704 4111 2920		NASHVILLE, TN

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☒ 14 day

SEDIMENT CHARACTERIZATION SITE 17 PETTIBONE CREEK

CONTAINER TYPE PLASTIC (P) or GLASS (G): G, G, G

PRESERVATIVE USED: 4°C, 4°C, 4°C

TYPE OF ANALYSIS: PAH (LL), PCBs, PESTICIDES, METALS, TOC | METALS, TOC, PH

DATE YEAR 2012	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT) cm	BOTTOM DEPTH (FT) cm	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	PAH (LL)	PCBs, PESTICIDES, METALS, TOC	METALS, TOC, PH						COMMENTS
3/27	1010	NTC17PCSD55	55	0	4	SD	C	2	1	1	—						
↓	1020	NTC17PCSD56	56	↓	↓	↓	↓	2	1	1	—						
	1038	NTC17PCSD57	57					2	1	1	—						
	1315	NTC17PCSD63	63					2	1	—	1						
	1510	NTC17PCSD64	64					2	1	1	—						
↓	1645	NTC17PCSD62	62					2	1	1	—						
3/28	0930	NTC17PCSD61	61					6	3	—	3						RUN ALSO MS/MSD
↓	1000	NTC17PCSD60	60					2	1	1	—						
	0000	FD032812-01	DUP					2	1	1	—						NTC17PCSD61
	1310	NTC17PCSD70	70					2	1	1	—						
	1325	NTC17PCSD71	71					2	1	1	—						
	1345	NTC17PCSD72	72					2	1	1	—						
↓	1410	NTC17PCSD59	59	↓	↓	↓	↓	2	1	—	1						@1410

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY [signature]	3.30.12	1000	1. RECEIVED BY FEDEX	3.30.12	1000
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | CHAIN OF CUSTODY | NUMBER № 027879 | PAGE 2 OF 2

PROJECT NO: 112G01021	FACILITY: NS GREAT LAKES	PROJECT MANAGER: BOB DAVIS	PHONE NUMBER: 412 921 7251	LABORATORY NAME AND CONTACT: EMPIRICAL, B. RICHARD
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER: KEITH SIMPSON	PHONE NUMBER: 412 352 2264	ADDRESS
		CARRIER/WAYBILL NUMBER: FEDEX 8764 4111 2920		CITY, STATE: NASHVILLE, TN

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☒ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G | G | G
PRESERVATIVE USED: 4°C | 4°C | 4°C

SEDIMENT CHARACTERIZATION SITE 17 PETTIBONE CREEK

DATE YEAR 2012	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (~~FT~~) CM	BOTTOM DEPTH (~~FT~~) CM	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	PAH (LL), PCBs, PESTICIDES	METALS, TOC	METALS, TOC, PH						COMMENTS
3/28	1505	NTC17PCSD54	54	0	4	SD	C	2	1	1	—						
↓	0000	FD032812-02	DUP	↓	↓	↓	↓	2	1	—	1						NTC17PCSD53
↓	1550	NTC17PCSD53	53	↓	↓	↓	↓	2	1	—	1						
3/29	0830	NTC17PCSD58	58	↓	↓	↓	↓	2	1	—	1						
↓	1132	NTC17PCSD65	65	↓	↓	↓	↓	2	1	—	1						
↓	1210	NTC17PCSD66	66	↓	↓	↓	↓	2	1	1	—						
↓	1400	NTC17PCSD69	69	↓	↓	↓	↓	2	1	1	—						
↓	1515	NTC17PCSD67	67	↓	↓	↓	↓	2	1	—	1						
↓	1540	NTC17PCSD68	68	↓	↓	↓	↓	2	1	1	—						

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY	3.30.12	1000	1. RECEIVED BY FEDEX	3.30.12	1000
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. — CHAIN OF CUSTODY — NUMBER Nº 027880 — PAGE 3 OF 3

PROJECT NO: 112G01021	FACILITY: NS GREAT LAKES	PROJECT MANAGER: BOB DAVIS	PHONE NUMBER: 412 921 7251
SAMPLERS (SIGNATURE):		FIELD OPERATIONS LEADER: KEITH SIMPSON	PHONE NUMBER: 412 352 2264
		CARRIER/WAYBILL NUMBER: FEDEX 8764 4111 2420	

LABORATORY NAME AND CONTACT: EMPIRICAL, B. RICHARD

ADDRESS:

CITY, STATE: NASHVILLE, TN

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☒ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G, G, P

PRESERVATIVE USED: 4°C, 4°C, HNO3

TYPE OF ANALYSIS: PAHs, PEST/PCBs, METALS

SAMPLED @ 0710

DATE YEAR 2012	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	PAHs	PEST/PCBs	METALS						COMMENTS
3/30	0710	RB033012-01	RB	—	—	QC	G	5	2	2	1						PLASTIC TROWEL DI WATER

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY	3.30.12	1000	1. RECEIVED BY FEDEX	3.30.12	1000
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS: NEW BRAND DI LOT 140569 EXP FEB 2013

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

TETRA TECH NUS, INC. CHAIN OF CUSTODY NUMBER Nº 027887 PAGE ____ OF ______

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G02120	GREAT LAKES - SITE 17	BOB DAVIS	412-921-7090	EMPIRICAL LAB - BRIAN RICHARD
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
		MARK MENGEL	724-777-0035	227 French Landing Drive STE 550
		CARRIER/WAYBILL NUMBER		CITY, STATE
		8770 7419 4939		NASHVILLE, TN 37228

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

TYPE OF ANALYSIS

DATE YEAR 2012	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	PEST./PCBS, PAH, METALS							COMMENTS
6/14	1500	NTC17PCSD50				SD	C	1	1							
6/14	1515	NTC17PCSD51-52				SD	C	2	2							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY Mark L Mengel	6-14-12	1900	1. RECEIVED BY FEDEX		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD 53
Sample Location: NTC17PCSD 53
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.28.12	1538	0-4 cm	BRN / GRAY	WET - SILT
Method: PLASTIC TROWEL			MORE BRN	SOME F SAND
				TR C TO MED SAND
Monitor Readings (Range in ppm): -				
	1546			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC, PH	4 oz w/m glass, 4° C	✓	
	2X VOL FOR	QA	

OBSERVATIONS / NOTES:

SAMPLED @ 1550

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 032812-02

Signature(s): [illegible]

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD 54
Sample Location: NTC17PCSD 54
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.28.12	1456	0-4 CM	BRN TO	WET - SILT
Method: PLASTIC			GRAY	TR F SAND
TROWEL				TR ROOTS
Monitor Readings				
(Range in ppm):				
—				
	1503			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1505

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD — Duplicate ID No.:

Signature(s): [signature]

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD55
Project No.:	112G01021	Sample Location:	NTC17PCSD 55
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.27.12	1000	0-4 CM	BRN	WET SILT & F. SAND
Method: PLASTIC TROWEL				TR CR TO M SAND
Monitor Readings (Range in ppm): —				
	1009			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	✓
Metals & TOC	4 oz w/m glass, 4° C	✓	✓

OBSERVATIONS / NOTES:

SAMPLE @ 1010

MAP:

SEE FIG. 7-1

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

[signature]

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Page 1 of 1

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD 56
Project No.:	112G01021	Sample Location:	NTC17PCSD 56
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
3.27.12	1012	0-4 CM	BRN	WET - SILT & F. SAND
Method:				TR. CR TO M SAND
PLASTIC TRWEL				
Monitor Readings (Range in ppm):				
	1018			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1020

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD57
Sample Location: NTC17PCSD57
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.27.12	1030	0 - 4 CM	BRN	WET - SILT & F. SAND
Method: PLASTIC TROWEL				TR C TO MED SAND
Monitor Readings (Range in ppm):				
	1036			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1038

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD 58
Sample Location: NTC17PCSD 58
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.29.12	0814	0 4 cm	BRN/GRAY	WET - SILT
Method: PLASTIC TROWEL				TR F SAND
				TR ROOTS
Monitor Readings (Range in ppm):				
	0821			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC , PH	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 0830

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD 59
Project No.:	112G01021	Sample Location:	NTC17PCSD 59
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.28.12	1400	0-4 cm	BRN TO	WET - SILT
Method: PLASTIC TROWEL			LT GRAY	SOME F TO CR
				SAND
Monitor Readings (Range in ppm):				TR F. GRAVEL
	1406			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC, PH	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1410

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD60
Sample Location: NTC17PCSD 60
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: Time: Method: Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.28.12	0950	0-4 CM	BRN/GRAY	WET - FINE SAND
Method: PLASTIC TROWEL				& SILT
				TR CR TO MED
Monitor Readings (Range in ppm): —				SAND
	0958			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1000

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

[signature]

0

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD 61
Sample Location: NTC17PCSD 61
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.28.12	0815	0-4 CM	BRN/GRAY	WET - SILT SOME
Method: PLASTIC TROWEL				F SAND
				TR M-CR SAND
Monitor Readings (Range in ppm): —				
	0822			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC, PH	4 oz w/m glass, 4° C	✓	
	4X VOC FOR	QA	

OBSERVATIONS / NOTES:

SAMPLED @ 0830

MAP:

SEE FIG 7-1

Circle if Applicable: YES

MS/MSD	Duplicate ID No.:
YES	FD 032812-01

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

Sample ID No.: NTC17PCSD62
Sample Location: NTC17PCSD62
Sampled By: K. Simpson
C.O.C. No.:

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 3.27.12	1635	0-4 CM	BRN/GRAY	WET SILT & F. SAND
Method: PLASTIC TROWEL				TR. M-CR. SAND
Monitor Readings (Range in ppm):				
	1641			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1645

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD63
Project No.:	112G01021	Sample Location:	NTC17PCSD63
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.27.12	1310	0-4 CM	BRN	WET - SILT & F SAND
Method: PLASTIC TROWEL			TO BRN/ GRAY	TR CR TO M. SAND
Monitor Readings (Range in ppm): —				
	1313			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC, PH	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1315

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Page 1 of 1

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD 64
Project No.:	112G01021	Sample Location:	NTC17PCSD 64
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.27.12	1450	0-4 CM	BRN/	WET - SILT & F
Method: PLASTIC			GRAY	SAND
TROWEL				TR C - MED SAND
Monitor Readings (Range in ppm):				
	1507			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLE @ 1510

MAP:

SEE FIG. 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD 65
Sample Location: NTC17PCSD 65
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.29.12	1125	0 - 4 cm	BRN	WET - SILT
Method: PLASTIC				TR F - C SAND
TROWELL				TR ROOTS
Monitor Readings				
(Range in ppm): —				
	1130			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	—	
Metals & TOC, PH	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1132

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

K Simpson

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD 66
Project No.:	112G01021	Sample Location:	NTC17PCSD 66
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.29.12	1203	0-4 cm	BRN	WET - SILT
Method: PLASTIC TROWEL				TR F-M SAND
				TR ROOTS
Monitor Readings (Range in ppm): —				
	1208			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1210

MAP:

SEE FIG. 7-1

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): [signature]

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD67
Sample Location: NTC17PCSD67
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.29.12	1508	0-4 cm	BRN	WET - SILT
Method: PLASTIC TROWEL				TR F-CR SAND
				TR ROOTS
Monitor Readings (Range in ppm): —				
	1514			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC, PH	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1515

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD 68
Sample Location: NTC17PCSD 68
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.29.12	1533	0-4 cm	BRN	WET - SILT
Method: PLASTIC				TR F TO CR SAND
TROWEL				TR ROOTS
Monitor Readings (Range in ppm):				
	1539			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1540

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Kit Si

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name: Naval Station Great Lakes
Project No.: 112G01021

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: NTC17PCSD 69
Sample Location: NTC17PCSD 69
Sampled By: K. Simpson
C.O.C. No.:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.29.12	1351	0 - 4 cm		WET - SILT
Method: PLASTIC				TR F SAND
TROWEL				TR ROOTS
Monitor Readings				
(Range in ppm):				ALSO -
—				TR M TO CR
				SAND
	1358			
	1358			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1400

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

[signature]

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD 70
Project No.:	112G01021	Sample Location:	NTC17PCSD 70
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3·28·12	1256	0-4 CM	GRAY/	WET SILT
Method: PLASTIC			OLIVE GRAY	TR F. SAND
TROWEL				SOME ROOTS
Monitor Readings (Range in ppm):				
	1306			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1310

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD 71
Project No.:	112G01021	Sample Location:	NTC17PCSD 71
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3·28·12	1315	0-4CM	BRN/	WET - SILT
Method: PLASTIC			GRAY	TR F SAND
TROWEL				TR ROOTS
Monitor Readings				
(Range in ppm): —				
	1321			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1325

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech, Inc.

SEDIMENT SAMPLE LOG SHEET

Project Site Name:	Naval Station Great Lakes	Sample ID No.:	NTC17PCSD 72
Project No.:	112G01021	Sample Location:	NTC17PCSD 72
		Sampled By:	K. Simpson
		C.O.C. No.:	

[ ] Surface Soil
[ ] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
3.28.12	1333	0-4 cm	BRN to	WET · SILT
Method: PLASTIC			GRAY	TR F. SAND
TROWEL				TR ROOTS
Monitor Readings				
(Range in ppm):				
—				
	1342			

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
PAH (LL), PCBs & Pesticides	4 oz w/m glass, 4° C	✓	
Metals & TOC	4 oz w/m glass, 4° C	✓	

OBSERVATIONS / NOTES:

SAMPLED @ 1345

MAP:

SEE FIG 7-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

WATER QUALITY METER CALIBRATION LOG

PROJECT NAME : **Great Lakes**
SITE NAME: **Site 17**
PROJECT No.: **112G01021**

INSTRUMENT NAME/MODEL: Horiba / U-52
MANUFACTURER: Horiba
SERIAL NUMBER: RWYXYM40

Date of Calibration	Person Performing Calibration	INITIAL READINGS PH (S.U.)	COND (mS/cm)	DO (mg/L)	Turb (NTU)	TEMP (°C)	FINAL READINGS PH (S.U.)	COND (mS/cm)	DO (mg/L)	Turb (NTU)	TEMP (°C)	Calibration Standard (Lot No.)	Remarks and Comments
3.27.12	KES	3.94	4.49	20.20	1.1	13.05	4.00	4.51	10.66	0	13.19	HORIBA AUTO CAL	
3.28.12	KES	4.16	4.48	7.43	0	15.96	3.99	4.50	10.02	0	15.96	LOT TIN462J3	
3.29.12	KES	4.17	4.69	16.91	1.4	15.82	3.99	4.50	13.79	0	15.82	EXP 12/12	

U.S. Environmental Rental Corporation
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INSTRUMENT
CALIBRATION
REPORT

Calibrated With Horiba Auto-Cal Solution

Lot Number T1N4G2J3

Parameter		Method	Before Calibration	After Calibration
	Conductivity 4.49 ms/cm			
	PH 4.01	Auto	4.0	4.0
	D.O.mg/l	Auto	9.45	10.45
	D.O. %	Auto	103.50%	114.30%
	Turbidity	Auto	0	0

Accessories

Flow Cell	x		
Barbs	x	Auto Cal	x
2 Cal Cups	x	Batteries	x
SensorGuard	x	Manual	x

Model	Horiba U-52
Serial #	RWyXyM40
Handset #	FJGFHX05M
Tech Initials	TL
Date	3/26/11

SITE PHOTOGRAPHS

Photo 1: Benthic Invertebrate Sample Collection

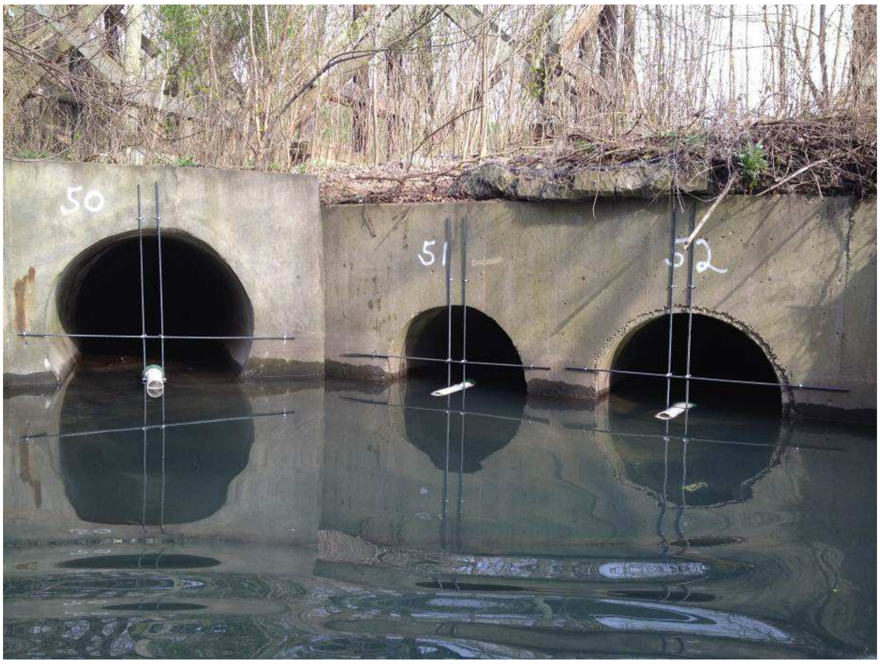

Photo 2: Sediment Trap Installation

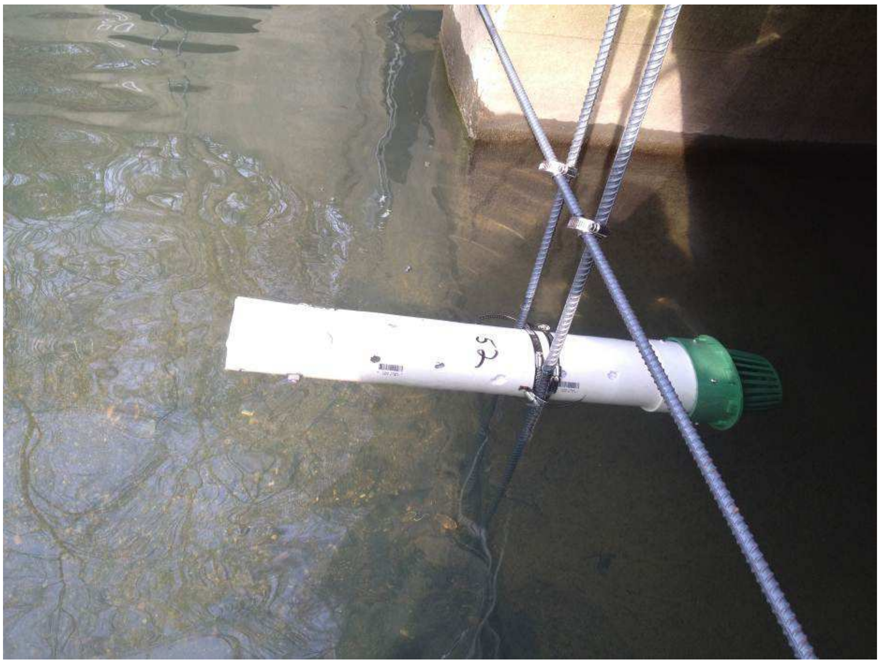

Photo 3: Sediment Trap

Photo 4: Sediment Traps Following Rain Event

Sediment Trap

Photo 5: Sediment Trap out of Position following Storm Event


Photo 6: NTC17PCSD53 Site Sampling Location Looking Upstream


Photo 7: NTC17PCSD53 Site Sampling Location Looking Downstream


Photo 8: NTC17PCSD59 Site Sampling Location Looking Upstream


Photo 9: NTC17PCSD59 Site Sampling Location Looking Downstream


Photo 10: NTC17PCSD66 Reference Sampling Location Looking Upstream


Photo 11: NTC17PCSD66 Reference Sampling Location Looking Downstream

APPENDIX B

BENTHIC COMMUNITY SURVEY REPORT AND PLOTS OF BENTHIC COMMUNITY METRICS VERSUS SEDIMENT CONCENTRATIONS

BENTHIC COMMUNITY SURVEY REPORT

Benthic Macroinvertebrate Conditions and Aquatic Life Habitat Characterization for Site 17 – Pettibone Creek

Naval Station Great Lakes
Great Lakes, Illinois

Prepared for:

Naval Facilities Engineering Command Midwest
201 Decatur Avenue, Building 1A
Great Lakes, Illinois 60088

Prepared by:

Tetra Tech, Inc.
Center for Ecological Sciences
400 Red Brook Boulevard, Suite 200
Owings Mills, Maryland 21117

TETRA TECH

May 18, 2012

Table of Contents

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1 Introduction and Background

This report presents the results of the benthic macroinvertebrate and habitat investigation conducted at Site 17 – Pettibone Creek is located at Naval Station Great Lakes (NSGL) in Great Lakes, Illinois. The benthic macroinvertebrate assemblage is a reliable indicator of ecological integrity (Tetra Tech, 2007, Bailey et al. 2004). The diversity and composition of macroinvertebrate samples are measurably responsive to a range of pollutants, including toxicants (Beasley and Kneale, 2004, Beketov and Liess, 2008), nutrients (Smith et al., 2007, Heatherly et al., 2007), metals (Clements, 2004, Schmidt et al., 2002), and physical habitat conditions (Heatherly et al., 2007, Lammert and Allen, 1999, Rogers et al., 2002). The Illinois Environmental Protection Agency (Illinois EPA) uses the Macroinvertebrate Index of Biotic Integrity (mIBI; Tetra Tech, 2007) as an indicator of biological conditions for assessment of aquatic life uses (ALU) in their Clean Water Act (CWA) programs. This index is responsive to a broad range of stressors and is appropriate for use in assessing conditions in the study area. Measures of the biological sample (metrics) that comprise the index or are otherwise responsive were also valuable for interpreting macroinvertebrate conditions.

Site 17 comprises Pettibone Creek (North and South Branches) and the Boat Basin. The North Branch of Pettibone Creek originates in North Chicago, enters the northwestern corner of NSGL, and flows south and east through the Naval Station until it enters the Boat Basin and discharges into Lake Michigan along the western shoreline (Figure 1). The South Branch of Pettibone Creek originates in a residential area southwest of the Naval Station, flowing northward through a golf course and the Naval Station. The North and South Branch of Pettibone Creek join approximately 1,500 feet west of Lake Michigan.

The majority of NSGL activities occur on a plateau atop a steep bluff that rises 70 feet above the beach along Lake Michigan. Pettibone Creek and its tributaries flow within a ravine that divides this plateau and discharges to the Boat Basin. Pettibone Creek ranges between 15 and 30 feet in width, and several inches to 2 feet in depth. Storm sewers that collect stormwater from a large section of the City of North Chicago drain to the creek upstream of Navy property (Illinois EPA, 1995) and 30 NSGL stormwater sewer system outfalls from roadway drainage systems drain to Navy property (Halliburton NUS, Inc., 1993). Because of the industrial and urban nature of this watershed, Pettibone Creek is subject to flash flooding and associated erosive forces during storm events. Sediment present in Pettibone Creek is mobile due to flash floods, and based on layering observed during previous Boat Basin investigations, creek bottom sediment is believed to deposit in layers eroded during storm events.

As can be seen in the aerial photograph (Figure 1), a variety of land uses currently surround NSGL, including urbanized and industrial areas to the north, industrial use to the west, and a mixture of public use land and residential neighborhoods to the south. The NSGL fronts 1.5 miles of Lake Michigan shoreline and has provided facilities and support to training activities and a variety of military commands since 1911 and also includes the Navy's only boot camp. A dirt path along the North Branch of Pettibone Creek is used for recreation, hiking, jogging, and walking (Figure 2a). The South Branch of Pettibone Creek flows at the base of steep slopes behind buildings and is less accessible and less used (Figure 2b). Pettibone Creek is not used as a drinking water source; however, people may wade and play in the creek. Fish are present in the creek and fish have been observed migrating upstream in the spring (Illinois EPA, 1995) and fall. No federally listed endangered or threatened species are known to exist in the area. The Mudpuppy salamander is listed as a threatened species that is protected by the State of Illinois. NSGL is conducting a study to determine whether the Mudpuppy salamander is present in Pettibone Creek and the Harbor at NSGL, along with some additional locations. One sampling event was conducted in July 2011, but no Mudpuppy salamanders were observed or captured in the area during this event. Two additional sampling events are planned for this area in 2012. Previous habitat assessments have determined that habitat suitable to threatened or endangered species does not exist in Pettibone Creek, at least in part because of the highly developed nature of the surrounding land (U.S. Navy, 2010). Fish consumption from recreational fishing is not an exposure pathway of concern because the Illinois EPA has instituted fish advisories to limit consumption of fish from Lake Michigan due to polychlorinated biphenyl (PCB) contamination.

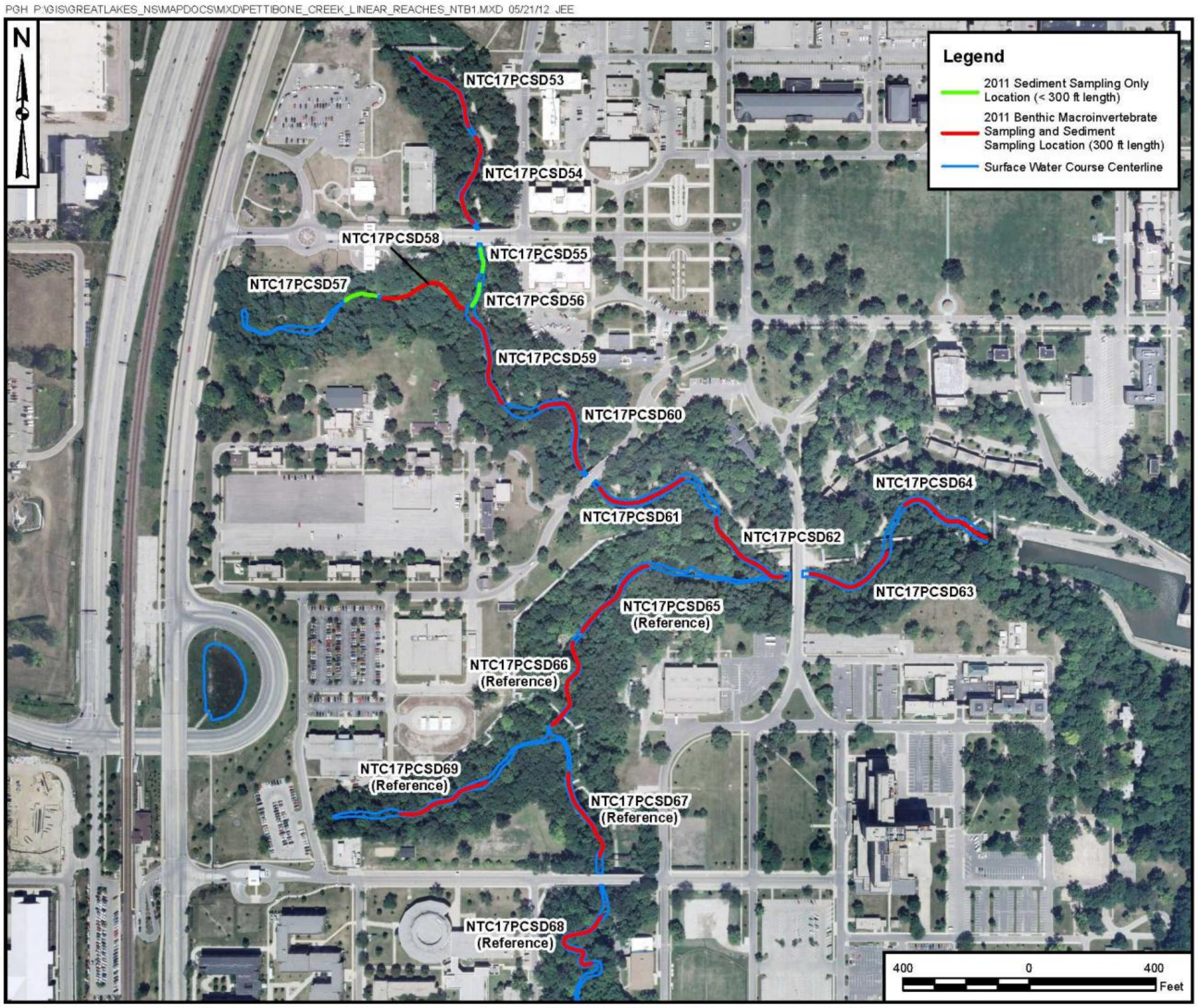

Figure 1. Site location map. Benthic samples and habitat observations were made in the sampling locations shown in red.

Figure 2. North Branch test site SD 60 looking upstream (a., left photo) and South Branch reference site SD 67 looking upstream (b., right)

Former industries located upstream of NSGL include the North Chicago Refiners and Smelters (NCRS), the Vacant Lot, and Fansteel. Discharges from these industries in combination with several storm sewers collecting water/runoff from a large section of the City of North Chicago, have contributed to elevated concentrations of contaminants in Pettibone Creek and Boat Basin sediments. These facilities were turn-of-the-20th century manufacturing facilities that produced tantalum mill products, non-ferrous metals, and zinc oxide.

The Navy identified potential areas (Navy and non-Navy) where hazardous materials may have been released to the environment at NSGL in the Initial Assessment Study (IAS) (Rogers, Golden, & Halpern and BCM Eastern Inc., 1986). The IAS identified 14 potentially contaminated sites along with potential sources such as surface runoff or fallout from engine exhaust from nearby roadways, historical pesticide usage, and volatile organic compounds (VOCs) detected in the groundwater samples collected from monitoring wells (Tetra Tech, 2005). A Watershed Contaminated Source document was prepared, which summarized activities that may have had an impact on sediments in Pettibone Creek and the Boat Basin (Tetra Tech, 2003a).

Pettibone Creek is in a stream valley with steeply eroded slopes. The topography of the valley includes a moderately steep stream gradient and banks and hillsides with 30- to 60-percent slopes that form the ravine through which Pettibone Creek flows. The valley elevations vary from approximately 600 feet above mean sea level (msl) at the tops of the Pettibone Creek hillsides to approximately 577 feet above msl at the Boat Basin, where the Pettibone Creek discharges to Lake Michigan (Tetra Tech, 2003b). The Pettibone Creek watershed drains an area of 4.2 square miles, and the creek consists of North and South Branches, each with minor tributary branches. The creek flows through well-defined ravines within NSGL. In general, flow in Pettibone Creek is eastward, with flow from both the North and South Branches joining within the limits of NSGL Property.

There is very little floodplain area along Pettibone Creek because of the steeply sloped banks. The North Branch of the creek has a short time of concentration (i.e., time it takes a unit of water to run the water course) because the source of water is primarily from an urban area with low infiltration rates and fast runoff rates during storms. As a result, Pettibone Creek is susceptible to flash floods characterized by high channel velocities and great erosive potential. The Illinois State Water Survey calculated the average flow rate of Pettibone Creek to be less than 10 cubic feet per second (cfs), which greatly increases during periods of precipitation (Tetra Tech, 2003b).

Pettibone Creek was partitioned into reference and test stream channels for this investigation. The test stream channel included the North Branch of Pettibone Creek starting directly downstream of a long culvert that runs south beneath Route 137 and ends at the Boat Basin and Lake Michigan. This is the area in which there is concern of sediment contamination that may be impacting the stream ecosystem. The potential contaminants and stressors include heavy metals, organic compounds (primarily polynuclear aromatic hydrocarbons [PAHs]), and harsh habitat conditions. Nine sampling sites, each defined as a 300 feet channel reach, were designated in the North Branch, including one in a small tributary. The South Branch of Pettibone Creek was sampled as a comparable standard, or reference, because it was assumed to be less impacted by some of the industrial stressors prevalent in the North Branch. However, the South Branch is subject to similar ambient, urban stressors as the North Branch, such as nutrient inputs, runoff contaminants, and flashy hydrology. Five sampling sites were defined on the South Branch, including one on a small tributary. The tributary to the South Branch is very small and its watershed appears to have mostly impervious land uses much like the watershed of the North Branch. The lowest portion of the South Branch was not sampled because it was suspected of exposure to waterborne contaminants because of the possibility of floodwater inundation (which would mix contaminants from the North Branch of Pettibone Creek).

2 Methods

Field sampling and sample processing for benthic macroinvertebrates followed the Draft Tier II Pettibone Creek Sampling and Analysis Plan (Tetra Tech, 2012), and were intentionally identical to those of Illinois EPA (Tetra Tech, 2007). In brief, field sampling methods included using a long handled D-frame net with a 595 µm mesh to produce a multi-habitat composite sample (a 20-jab sampling technique) from each of the sampling reaches. In the laboratory, a 300 organism subsample was sorted and organisms were identified to specified levels of taxonomic detail (usually genus). Fieldwork occurred during the week of March 26-30, 2012 and laboratory processing was completed by April 11, 2012.

Taxonomic lists for each site were entered into EDAS, a Microsoft Access-based relational database (Tetra Tech, 1999). Metrics of the mIBI were calculated in the database, scored, and combined as a single index value, according to Illinois EPA methods (Illinois EPA, 2011). Analysis included comparison of index and metric values within and among reference (South Branch) and test (North Branch) site types. Narrative condition ratings have been associated with the mIBI scale (Illinois EPA, 2011) and were used in this study to generally characterize site level biological condition. However, the samples were not collected during the sampling season used by the Illinois EPA (the index period), and thus, the ratings are not necessarily indicative of aquatic life use attainment. The best application of the mIBI in this study is for comparisons between reference and test site samples, all of which were collected in the same week.

Variability of the index in reference sites (field sampling precision) was described using standard deviations of mIBI scores within different sets of sites (Stribling et al., 2008). Because the reference sites were very close to each other (Figure 1), the pairs above and below the tributary were considered as replicates for mIBI precision estimates. The tributary itself was thought to be essentially different than the main channel of the South Branch due to its size and contributing watershed. With the precision estimates, statistical comparisons of mIBI scores among individual sites were possible. Precision was quantified as the 90% confidence interval (CI90), which is calculated as a multiple of the root mean square error (RMSE * 1.645) from Analysis of Variance (ANOVA) with mIBI scores from the two pairs of reference sites. The CI90 is the interval around an observation in which we expect to find the true mean in 90% of the cases.

Stream habitat conditions were characterized using the Qualitative Habitat Evaluation Index (QHEI) (Tetra Tech, 2012), which is calculated by summing scores for six individual measurements of instream and riparian conditions. In addition, the substrate particle size in each sampling site was characterized using systematically random pebble counts.

2.1 Quality Assurance / Quality Control Process

Quality assurance/quality control (QA/QC) is a series or program of activities designed to evaluate data quality and to document data characteristics. To provide a measure of data quality (i.e., the reliability of these assessments), performance characteristics for the various laboratory standard operating procedures (SOPs) were established, along with recommended measurement quality objectives (MQO) for tracking performance (Table 1). This documentation is intended to enhance defensibility of data and assessments. QA/QC on laboratory sample processing (sorting efficiency [bias of the sorting/subsampling process] and taxonomic identification precision) was performed on three randomly selected samples for each process, and was completed by April 25, 2012. For sorting efficiency, the sort residue from three samples was checked by an independent laboratory. The numbers of missed organisms recovered in the sort residue were used to calculate percent sorting efficiency (PSE, Flotemersch et al., 2006).

To determine estimates of precision for taxonomic enumeration and identification (Stribling et al., 2003), three samples were randomly selected for re-identification by an independent laboratory/taxonomist. Samples were sent to the second laboratory with site information only (i.e., without identifications), thus representing blind samples. Results from each lab were compared and precision estimates were calculated (percent difference in enumeration [PDE], percent taxonomic disagreement [PTD], Stribling et al., 2003).

Table 1. Measurement quality objectives (MQO) recommended for tracking key performance measures.

Performance Characteristic	MQO
Sorting/subsampling accuracy (percent sorting efficiency [PSE])	PSE≥90, for ≥90% of externally QC'd sort residues
Taxonomic precision (percent taxonomic disagreement [PTD])	Median PTD ≤15% for overall sample lot; samples with PTD ≥15% examined for patterns of error
Taxonomic precision (percent difference in enumeration [PDE])	Median PDE ≤5%; samples with PDE ≥5% should be further examined for patterns of error

3 Results

3.1 Sample Collection and Processing

Recent site disturbance was observed in the two most downstream test sites (SD63 and 64), in which channel clearing one day prior to sampling was noted in field comments (Table 2). Through conversations with on-site personnel, the sampling crew determined that channel clearing is a standard procedure for these sites, that this incidence was not unusual, and that the benthic samples from these sites should be comparable to the other samples. Other field comments suggest that the channels are subject to extreme flows, as evidenced by scouring to the silt/clay layer, eroded banks, and rip-rap armored banks. Habitat observations (Appendix A) and photos (Appendix B) corroborate these comments.

Table 2. Comments on sampling station condition from field observations.

StationID[a]	Site Type	Comment
SD53	Test	Reach is located directly downstream of long culvert that runs south beneath route 137. Deep pool on upstream end, not characteristic of rest of reach. Left bank shored with rip-rap (looks to be construction debris, some of which has fallen into stream channel). Relatively low flow at time of sampling. Attached algae throughout reach. Flows look to be flashy during precipitation events.
SD54	Test	Stream is reasonably shallow throughout reach. High amount of bank erosion.
SD59	Test	High level of bank erosion. Portion of reach scoured to silt-clay layer.
SD60	Test	Left bank shored with rip-rap for majority of reach. Right bank erosion evident. Majority of reach lacks in stable/quality habitat.
SD61	Test	Large portion of right bank is rip-rap. Reach alternated between shallow and deep areas due to channel modifications (See photos).
SD62	Test	Heavily eroded and incised stream. Some rip-rap present on banks and within channel (old construction debris).
SD63	Test	Highly modified channel. Heavy erosion outside of reach (upstream and downstream). Much of substrate looks to be construction debris. Base maintenance normally clears woody debris from channel for flood control. Area was partially cleared prior to sampling
SD64	Test	Bottom of reach was disturbed a day prior to sampling due to fallen trees and subsequent maintenance crew cleanup. The channel is normally cleared for flood purposes. Entire left bank is shored with rip-rap.
SD58	Test Trib.	Reach located in narrow v-shaped valley with heavily eroded banks. Areas of reach are scoured down to silt-clay layer.
SD65	Reference	Heavily eroded banks with many trees falling into channel. Portions of reach scoured to silt-clay layer.
SD66	Reference	Heavily eroded banks. Portions of reach scoured to silt-clay layer.
SD67	Reference	Right bank riparian is a cleared area (mowed grass).
SD68	Reference	Reasonable amount of bank erosion along bends. Upstream end of reach is large pool with decent bank stability/bank habitat (undercuts/deep water) although substrate is predominantly fine. Downstream portion of reach indicates high erosion potential.
SD69	Ref. Trib.	Very small stream, low flow, unstable/eroded banks.

a: For this analysis, station identifiers have been abbreviated from the longer names used elsewhere. For example, "SD53" was used here where "NTC17PCSD53" has been used in the SAP.

Primary taxonomic data are represented in Appendix C. QC assessment indicated that laboratory processing of the benthic macroinvertebrate samples met the MQO. For the sorting process, the PSE showed that more than 90% of organisms were sorted initially in each of the three samples tested (0% failure of the MQO), so no issues or corrective actions were necessary (Table 3). There was also adequate taxonomic precision, with < 5 DPE and < 15 PTD in each sample (0% failure of the MQO), so no issues or corrective actions were necessary (Table 4). Detailed taxonomic comparison results are presented in Appendix D.

Table 3. Sorting and subsampling bias.

Station ID	Number of specimens			PSE
	Original	Recovered	Total	
SD-53	299	16	315	94.9
SD-67	247	9	256	96.5
SD-68	269	8	277	97.1

Table 4. Taxonomic identification precision.

Station ID	PDE	PTD
SD59	1.0	2.7
SD61	0.2	6.7
SD62	1.3	3.7
mean	0.8	4.4
st. dev.	0.57	2.08

3.2 Benthic Sample Composition

In the samples, 3925 individuals were identified from 70 taxa (Appendix D). Insects were represented by 52 taxa and 40% of the individuals. Most of the organisms in the samples were worms (Annelida: Oligochaeta) and chironomids (Insecta: Chironomidae), which are typically tolerant of pollutants (Merritt et al., 2008).

By far the most abundant group was the worms (Oligochaeta), which made up 45% of the individuals. The mIBI calculation requires worm taxonomic identification data only at subclass (Oligochaeta), the coarseness of the identifications likely reducing sensitivity of the index among the sites. However, the taxonomist identified worms to genus for most specimens. While most taxa occurred in both reference and test sites, three taxa occurred only in the test sites; *Bothrioneurum*, *Paranais*, *Potamothrix*, *Pristina*. Two other worms, *Ilyodrilus* and *Chaetogaster*, only occurred in one and two reference sites, respectively.

Of the insects identified in the samples, the predominant type was midges (Diptera: Chironomidae). They made up 85% of the insect individuals in 28 taxa. Midges generally burrow in soft sediments and are tolerant of pollutants. According to tolerance values associated with each taxon by the Illinois EPA, not all of the midges were characterized as tolerant genera. Taxa with high tolerance values (TV ≥ 7) are considered tolerant of pollution. Seven midge taxa occurred only in reference sites, including Ablabesmyia (TV=6), Dicrotendipes (TV=8), Micropsectra (TV=4), Nanocladius (TV=3), Parachironomus (TV=8), Paraphaenocladius (TV=6), and Rheocricotopus (TV=6). Two tolerant midge taxa were only found in test sites, including Chironomus (TV=11) and Zavrelimyia (TV=8).

Non-midge flies (Diptera) made up about 1% of the individuals. Other insects included beetles (Coleoptera), dragonflies (Odonata), and caddisflies (Trichoptera), each comprising almost 5% of the individuals. There were only three beetle taxa, *Stenelmis* (occurring in both reference and test sites), Curculionidae (a single individual occurring in a test site), and *Agabus* (a single individual occurring in the reference tributary). The dragonflies were more diverse in the reference sites, with four taxa. In test sites, only two taxa were observed. One damselfly taxon (Odonata: Calopterygidae: *Calopteryx*) was more common in test sites than it was in reference sites.

Test site NTC17PCSD63 had a high number of taxa (30) and higher than average concentrations of copper, lead, and zinc. Five of the 30 taxa (17%) were considered tolerant (tolerance values ≥ 7). In comparison, eight of 31 taxa (26%) were tolerant in reference site NTC17PCSD67, with the highest number of taxa and low concentrations of metals. High diversity does not appear to be due to tolerant taxa in this case. The tolerant taxa that were common to both samples included Oligochaeta, Tanytarsus, Cryptochironomus, and Stenelmis. Unique to the test site was Chironomus, which has the highest possible tolerance value (11).

It appears that taxa diversity was not driven by pollution tolerant taxa. Taxa richness is typically driven by sensitive taxa, that tend to occur in lower numbers and to disappear when stresses cause unsuitable conditions. Tolerant taxa are sometimes present in low numbers even when environmental conditions are relatively good and they increase in numbers as conditions worsen. Changes in abundance may have no effect on richness. Using the same samples discussed above, two taxa in the test sample were intolerant of pollution (tolerance values ≤3) as were three taxa in the reference sample.

Taxa in the sensitive insect orders Ephemeroptera, Plecoptera, and Trichoptera (EPT; mayflies, stoneflies, and caddisflies) are commonly used to indicate biological conditions in streams. Only Trichoptera were found in the project samples. Several mayflies are sensitive to metals and stoneflies usually require cold, well-oxygenated waters. The study site has low level metal contamination and may be warm during summer low flows, conditions that are not generally suitable for mayflies and stoneflies. The Trichoptera taxa were in the moderately tolerant *Hydropsyche* and *Cheumatopsyche* (Trichoptera: Hydropsychidae). These are net-spinning filter feeders that were equally common in reference and test sites.

The taxonomist noted that some of the isopods were parasitized by acanthocephalans, or thorny-headed worms, however, it is unknown whether this is an indicator of environmental stress (Todd Askegaard, personal communication, April 9, 2012). As a primary part of their basic life cycle, acanthocephalans live in fish intestines, and are expelled as eggs in feces, shortly becoming ingested by isopods (Crustacea: Isopoda: aquatic sowbugs) (and probably other organisms, as well). The parasite causes the isopod to become more active and may cause its pigmentation to become lighter, likely increasing their visibility against leaf litter and potential of becoming targets of fish predation. Ingestion of the infected sowbugs perpetuates the cycle. The parasite can cause considerable damage to the fish intestine.

3.3 Benthic Index Results

The samples had mIBI scores indicating biologically degraded conditions, with assessment ratings of "Fair" and "Poor" (Table 5). The threshold between "Fair" and "Poor" is 20.9 index points. In general, the Pettibone Creek reference site mIBI scores were in the "Fair" assessment category and test site index values were rated as "Poor" (Figure 3). However, there was some crossover. The small tributaries of both the reference and test sites had the lowest mIBI values in their respective categories. These small tributaries may have intermittent flow, which would be a stressful condition compounding any stresses due to water quality conditions and leading to the "Poor" assessments by the mIBI. The test sites with scores in the "Fair" range were in the lower portions of the channel (Figure 4). A t-test of mIBI scores among non-tributary sites indicated a significant difference ($p = 0.009$) between reference and test site scores.

The scores of each of the metrics were consistently low, with the exceptions of Total Taxa and the Modified Biotic Index (MBI, a composite score of pollution tolerances for individuals), which have moderate scores (Table 5). Average metric scores in reference sites were consistently higher than the average of test site scores. No mayflies were identified in any sample, so the Ephemeroptera Taxa metric was invariable among reference and test site types. The percentage of individuals that scrape substrate surfaces for food resources (%scrapers, Merritt et al., 2008) were notably higher in reference sites as compared to test sites. If scouring is frequent in the test channel, then substrate, food resources, or the scrapers themselves may be carried away during spates. In addition, contaminants accumulated in the aufwuchs (=periphyton) are consumed by scrapers, who are therefore exposed to contaminants more so than organisms that consume in some other manner. Other metrics that on average score better in reference sites compared to test sites are Total Taxa, Coleoptera Taxa, Intolerant Taxa, and the MBI.

Densities were calculated from the laboratory subsampling data, and were seen to be higher in reference sites than in test sites, in most cases (Table 5). However, the highest density was found in one of the downstream test sites. Low densities have been linked to stressful habitat and water quality conditions (Gray, 2004).

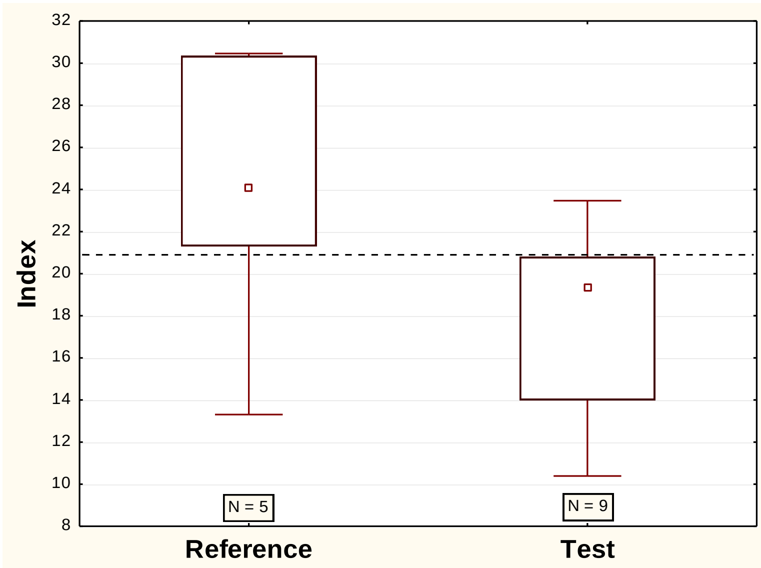

Figure 3. Distributions of mIBI scores among reference and test sites. The horizontal dashed line is the threshold between "Fair" and "Poor" biological conditions.

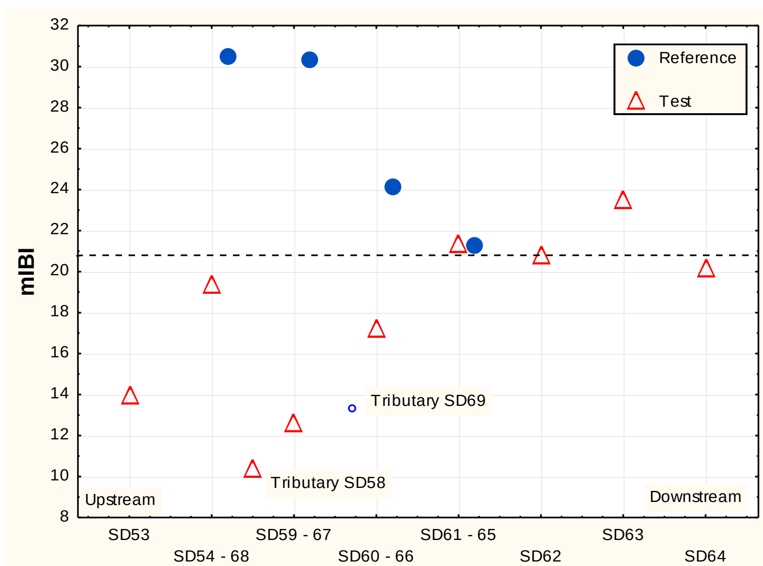

Figure 4. Index values (mIBI) in relation to stream reference status (reference or test) and location, arranged from upstream to downstream positions. The reference and test channels meet at the lower end of site SD62. The horizontal dashed line is the threshold between "Fair" and "Poor" biological conditions.

Table 5. Macroinvertebrate Index of Biotic Integrity (mIBI) and component metric values and scores in reference (Ref) and test sites.

StationID	**SD53**	**SD54**	**SD59**	**SD60**	**SD61**	**SD62**	**SD63**	**SD64**	**SD58**	**SD65**	**SD66**	**SD67**	**SD68**	**SD69**
Site Type	Test	Test	Test	Test	Test	Test	Test	Test	TestTrib	Ref	Ref	Ref	Ref	RefTrib
mIBI	14.0	19.4	12.6	17.2	21.3	20.8	23.5	20.2	10.4	21.3	24.1	30.3	30.5	13.3
Index Rating	Poor	Poor	Poor	Poor	Fair	Poor	Fair	Poor	Poor	Fair	Fair	Fair	Fair	Poor
Total Taxa	21	22	20	25	25	28	30	24	13	21	29	31	30	17
Total Taxa Score	45.7	47.8	43.5	54.3	54.3	60.9	65.2	52.2	28.3	45.7	63.0	67.4	65.2	37.0
Ephemeroptera Taxa	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephem. Taxa Score	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coleoptera Taxa	0	1	0	0	0	1	1	1	0	1	1	1	1	0
Coleoptera Taxa Score	0	20	0	0	0	20	20	20	0	20	20	20	20	0
EPT percent	0.00	0.36	1.75	5.45	3.33	0.38	0.66	2.08	0.00	3.57	3.46	3.63	0.75	3.03
EPT % Score	0.00	0.49	2.36	7.36	4.50	0.52	0.90	2.81	0.00	4.83	4.67	4.90	1.01	4.10
Scraper percent	0.67	1.45	1.05	1.17	1.48	3.44	4.32	3.46	0.32	7.50	6.92	10.48	10.82	3.41
Scraper % Score	2.26	4.91	3.54	3.94	5.01	11.61	14.59	11.69	1.10	25.34	23.37	35.42	36.56	11.52
Intolerant Taxa	1	1	0	0	1	1	2	2	1	1	1	3	2	0
Intolerant Taxa Score	11.11	11.11	0.00	0.00	11.11	11.11	22.22	22.22	11.11	11.11	11.11	33.33	22.22	0.00
MBI	8.63	7.88	8.63	7.65	6.47	8.47	8.48	9.03	9.03	8.42	8.16	7.87	6.84	8.52
MBI score	38.92	51.22	38.81	54.98	74.33	41.48	41.33	32.37	32.24	42.22	46.59	51.35	68.19	40.58
Total Individuals	301	278	301	279	328	270	346	297	324	283	342	268	273	294
Density	1806	2085	2419	837	984	1157	2595	5569	1389	3980	2565	2741	4388	2756

Sample collected by Illinois EPA from other locations in the region during their standard index period had mIBI scores ranging from 14 to 63, in the "Poor", "Fair", and "Good" range (Table 6). Among the 12 Illinois EPA samples from sites between Kenosha, WI and Glencoe, IL and west as far as Libertyville, IL, the site with the lowest mIBI score also appeared to have the greatest amount of urban land use in the catchment (GoogleEarth, aerial images). No conclusions regarding the health of the benthic community in Pettibone Creek were based on this additional information.

Table 6. Index (mIBI) scores for benthic samples collected by Illinois EPA from sites near the Pettibone Creek watershed (unpublished data used in mIBI calibration [Tetra Tech, 2007]).

StationID	Waterbody Name	Latitude	Longitude	CollDate	mIBI
04087258	Pike River at Cth A Near Kenosha, Wi	42.6536	-87.8504	8/24/04	52.0
04087270	Pike Creek at 43Rd Street At Kenosha, Wi	42.5970	-87.8284	8/24/04	13.8
05527729	Kilbourn Ditch at 60th Street Near Kenosha, Wi	42.5822	-87.9501	8/23/04	55.8
05527800	Des Plaines River at Russell, Il	42.4892	-87.9265	7/12/99	53.3
05527800	Des Plaines River at Russell, Il	42.4892	-87.9265	7/13/99	63.3
05527800	Des Plaines River at Russell, Il	42.4892	-87.9265	7/13/99	54.8
05527800	Des Plaines River at Russell, Il	42.4892	-87.9265	7/18/00	51.4
05527800	Des Plaines River at Russell, Il	42.4892	-87.9265	8/8/01	43.6
05527960	Mill Creek at Wadsworth, Il	42.4186	-87.9379	7/18/00	55.4
05528032	Bull C Below Milwaukee Ave nr Libertyville,Il	42.3145	-87.9623	7/17/00	59.8
05534460	N Br Chicago R At Deerfield Rd at Deerfield, Il	42.1675	-87.8290	7/17/00	28.3
05535100	Skokie River at Glencoe, Il	42.1378	-87.7845	7/17/00	27.8

3.4 Index Variability

The standard deviation of mIBI values in the four non-tributary reference sites is 4.6 index units, on a 100 point scale. The reference tributary was noted to be a very small channel and had only "Fair" habitat quality (QHEI = 52). For these reasons, it may not be an appropriate reference for the non-tributary test sites. In addition, these conditions may contribute to mIBI variability that is due to environmental conditions rather than the sampling variability that is quantified when considering index precision. If the tributary sample is included in reference sites, the standard deviation of the reference sites increases to 7.1 index units.

Confidence intervals were calculated using two sets of reference sites, the pair above the reference tributary and the pair below it. Within each set, the biological conditions were expected to be most similar because the sites were adjacent, habitat conditions were nearly identical, and water quality was assumed to be identical (no additional tributary inputs within the sets of sites, only between them). The RMSE from ANOVA for the two pairs of reference sites was 1.4 index units. This yields a CI90 of ±2.3 index units around any single observation. This small confidence interval on a 100 point index scale indicates that the field sampling precision was very good.

When comparing one site to another, differences >2.3 index units are likely to be different due to something other than sampling error. There are four samples with mIBI scores >2.3 index units below the lowest non-tributary reference index score (Figure 4). The two best reference mIBI scores (sites SD 67 and SD68 above the South Branch tributary) are significantly higher than the other scores ($p<0.05$).

3.5 Habitat Conditions

Habitat quality was relatively consistent among sites, with QHEI scores ranging from 52 to 66 in reference sites and 49.5 to 61 in test sites (Table 7). Most of the reference sites had QHEI scores in the “Good” range, as did many of the test sites, the latter of which fell mostly in the lower portions of the North Branch (Figures 5, 6). The sites with the highest habitat score was reference site SD68 (Figure 7). Three test sites tied for the lowest score, SD54, SD 58, and SD 59 (Figure 7).

Appendix A presents the habitat evaluation index and use assessment field sheets. Six variables are considered in the overall QHEI score, as listed below in Table 7. Each of the variables have different maximum values, as presented on the field sheets in Appendix A. The habitat variables that were most strongly related to the QHEI score (Pearson correlation coefficient > 0.55) were instream cover, channel morphology, and pool/glide, riffle/run quality. Bank erosion and riparian zone, gradient, and substrate were not significantly related to the QHEI score ($p>0.05$). This may be due to low variability among sites for these variables. For example, the rating for the gradient variable was 10 in all sites. As can be seen in site photos (Appendix B), the sites have similar characteristics in terms of substrates, channel conditions, and riparian stability and vegetation.

Table 7. Qualitative habitat evaluation index (QHEI) scores and ratings of the individual variables for each of the sampling stations.

StationID	Ref/Test	A[1]	B	C	D	E	F	QHEI score
SD53	Test	4	6	10	10	10	14	54
SD54	Test	3	7	10	8	7	14	49.5
SD59	Test	3	5	10	10	9	12	49.5
SD60	Test	4	8	10	10	13	14	59.5
SD61	Test	4	8	10	10	14	14	61
SD62	Test	5	5	10	10	13	14	56.5
SD63	Test	4	9	10	14	11	13	61
SD64	Test	5	8	10	9	11	14	56.5
SD58	TestTrib	4	7	10	8	8	12	49.5
SD65	Ref	4	10	10	12	12	14	62.5
SD66	Ref	4	7	10	14	11	12	58.5
SD67	Ref	5	6	10	13	8	14	55.5
SD68	Ref	6	14	10	15	9	12	66
SD69	RefTrib	5	10	10	10	5	12	52

[1]*Column headers*: Ref/Test, status of site as either reference or test; *A*, bank erosion and riparian zone; *B*, channel morphology; *C*, gradient; *D*, instream cover; *E*, pool/glide and riffle/run quality; *F*, substrate.

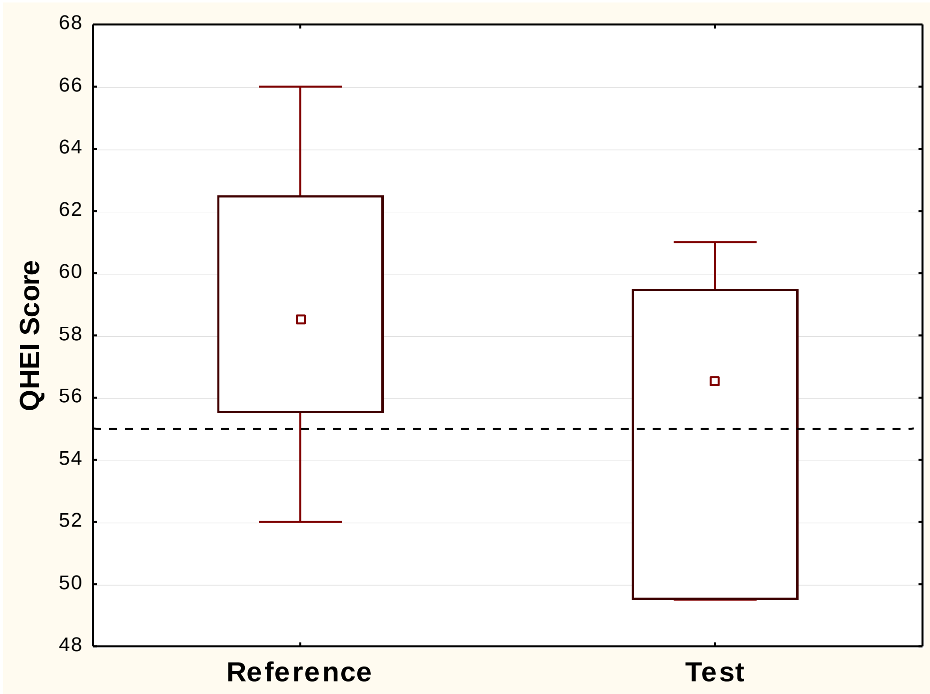

Figure 5. The horizontal dashed line (QHEI = 55) is the threshold between "Good" and "Fair" conditions (Ohio EPA, 2006).

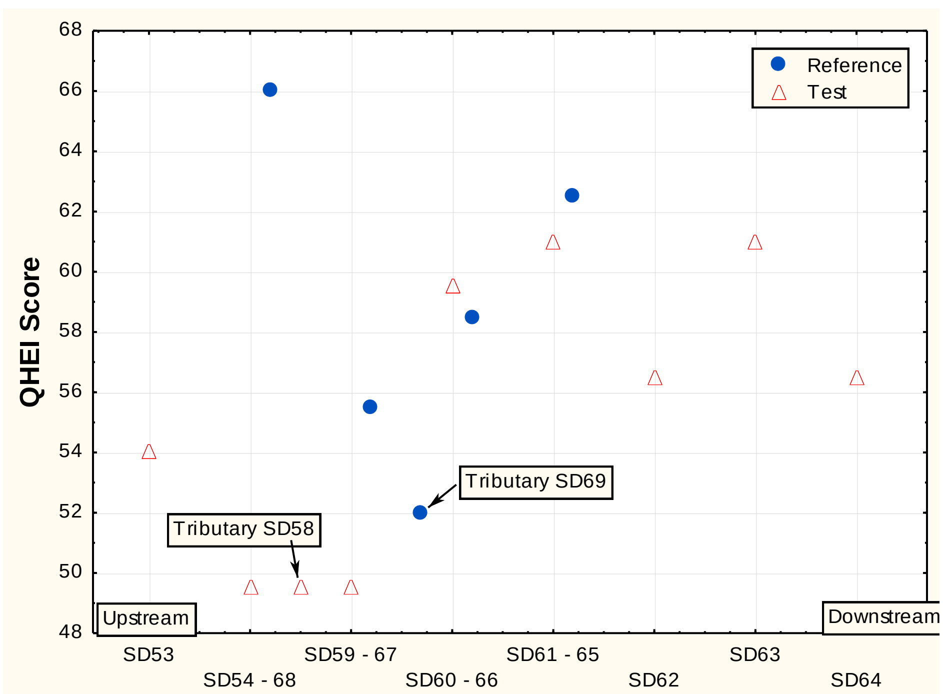

Figure 6. QHEI values in relation to stream reference status and sites.

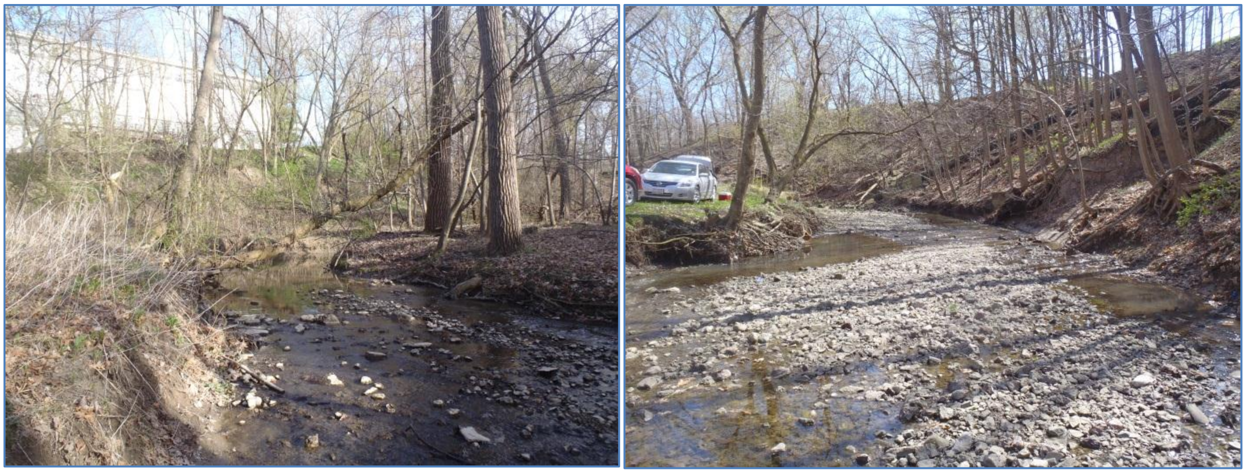

Figure 7. Examples of habitat conditions that are "Good" (reference site SD68 looking upstream, left photo) and "Fair" (poorest in this study, test site SD59 looking downstream, right photo).

3.6 Pebble Counts

Substrates in the North Branch of Pettibone Creek (test) were mostly gravel-sized particles (Table 8). Gravel can provide good habitat for benthic macroinvertebrates if it is not clogged with finer particles, that is, non-embedded (Waters, 1995, Wood and Armitage, 1997). The habitat benefits of gravel are that there is substantial surface area for primary production and there is a potential for interstitial spaces for organisms to hide, find food, or otherwise interact. Some sites had high percentages of silt/clay, those ≥20% are SD58, 59, 65, 67, and 68 (Table 8). These sites were also noted as being scoured, so the silt/clay was hardpan, having habitat quality comparable to bedrock. Hardpan and bedrock are stable, but with minimal surface area and interstitial spaces. The percentage of sand, silt, and clay and the median particle size among sites suggests that the upstream reference sites have more fine particles than the upstream test sites where scouring was noted.

4 Interpretation and Recommendations

Biological conditions in the Pettibone Creek stream channels on the NSGL base are somewhat or severely impaired. This is evident from the mIBI scores, that are in the "Fair" and "Poor" range, and from the composition of the samples, which are dominated by generally tolerant worms and midges. If the samples had been collected during the June to October index period specified by Illinois EPA instead of in March, the scores may have been slightly higher, perhaps improving ratings for some sites into the "Good" assessment category. This conjecture is based on the theory that some insect taxa have small developmental stages in winter that may not have been identified in the samples, but they would grow and be more readily sampled in summer samples. An increase in insect taxa would probably result in increased mIBI scores.

Judging from the available samples, biological conditions are impaired throughout the study area. Furthermore, the mIBI scores are related to environmental conditions of individual sites, including sediment chemistry and physical habitat conditions. The biological index and the QHEI were highly correlated ($r = 0.69$) (Figure 8), with the regression coefficient ($r^2 = 0.48$) suggesting that 48% of the variability in the biological index can be attributed to the QHEI and 52% of the variability is due to other factors. There are obvious limitations to the benthic macroinvertebrate assemblage that are due to habitat conditions. Other factors that may be limiting biological conditions could include water quality, sediment toxicity, and unmeasured habitat factors.

Table 8. Percent particle size distribution for each sampling station determined by systematic random, 100-particle modified Wolman pebble count. Percent sand, silt, and clay (%SSC) is a general indicator of substrate granularity. The median particle size (MedSize) and size classes are shown in millimeters.

StationID	RefType	Silt/Clay	Sand	Gravel	Cobble	Boulder	%SSC	MedSize
Size classes		<.062	.062-2	2-64	64-256	>256		
SD53	Test	1	15	56	24	4	16	40
SD54	Test	7	10	68	15	0	17	40
SD59	Test	20	22	42	13	3	42	10
SD60	Test	7	16	64	7	6	23	20
SD61	Test	11	14	51	19	5	25	28
SD62	Test	12	19	61	7	1	31	14
SD63	Test	14.1	19.2	61.6	5.1	0	33.3	20
SD64	Test	9	20	57	6	8	29	20
SD58	TestTrib	20.2	8.1	62.6	8.1	1.0	28.3	20
SD65	Ref	30	5	53	12	0	35	20
SD66	Ref	12	16	69	3	0	28	14
SD67	Ref	23.2	32.3	41.4	3.0	0	55.5	0.75
SD68	Ref	33	20	37	10	0	53	0.75
SD69	RefTrib	15	15	63	7	0	30	20

The biological conditions of the sites can be ranked from best to worst based on the mIBI (Table 9). Within this list, we can compare the significance of the different mIBI scores using the CI90 of ±2.3 index units (see Section 3.4). The best two reference sites, furthest upstream on the South Branch, have similar mIBI scores that are significantly higher than any others. The sites with mIBI scores significantly worse than the lowest reference score include test sites SD60, SD53, and SD59, and the two tributary sites. The mIBI scores are included on the site map in Figure 9 to help spatially conceptualize the gradient of biological integrity.

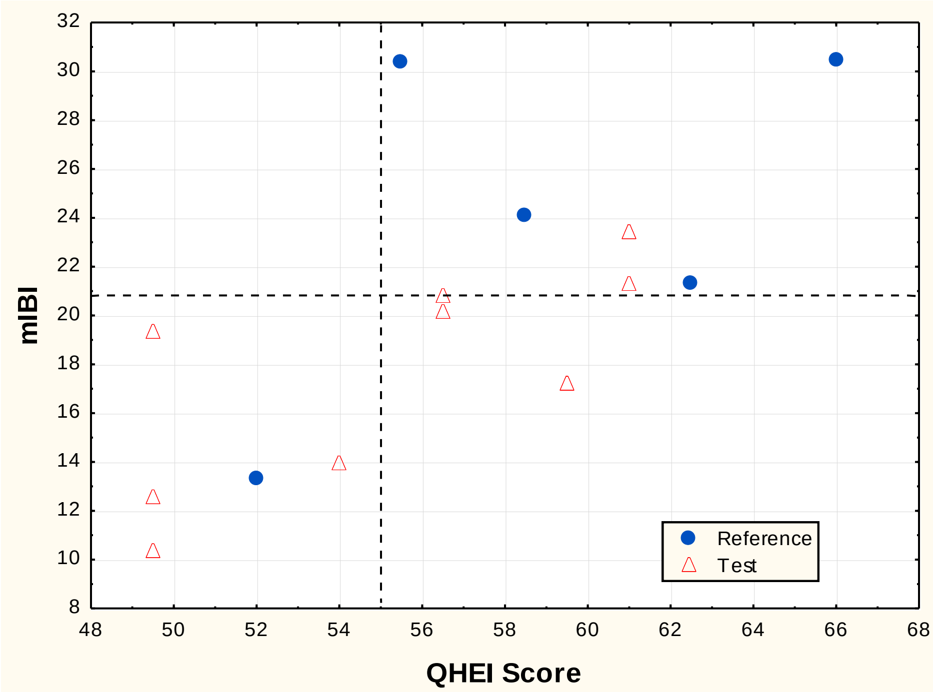

Figure 8. Biological index (mIBI) scores in relation to QHEI scores, showing thresholds between "Fair" and "Poor" biological conditions (horizontal line) and "Good" and "Fair" habitat conditions (vertical line).

Table 9. Ranking of sites from best to worst biological condition based on the mIBI score.

StationID	Site Type	mIBI	Similarities[1]
SD68	Ref	30.5	a
SD67	Ref	30.3	a
SD66	Ref	24.1	b
SD63	Test	23.5	b, c
SD65	Ref	21.3	c, d
SD61	Test	21.3	c, d
SD62	Test	20.8	d
SD64	Test	20.2	d
SD54	Test	19.4	d, e
SD60	Test	17.2	e
SD53	Test	14	f
SD69	RefTrib	13.3	f
SD59	Test	12.6	f, g
SD58	TestTrib	10.4	g

1: mIBI scores with identical letters are not significantly different ($p>0.1$)

PGH P:\GIS\GREATLAKES_NS\MAPDOCS\MXD\PETTIBONE_CREEK_LINEAR_REACHES_NTB2.MXD 05/23/12 JEE

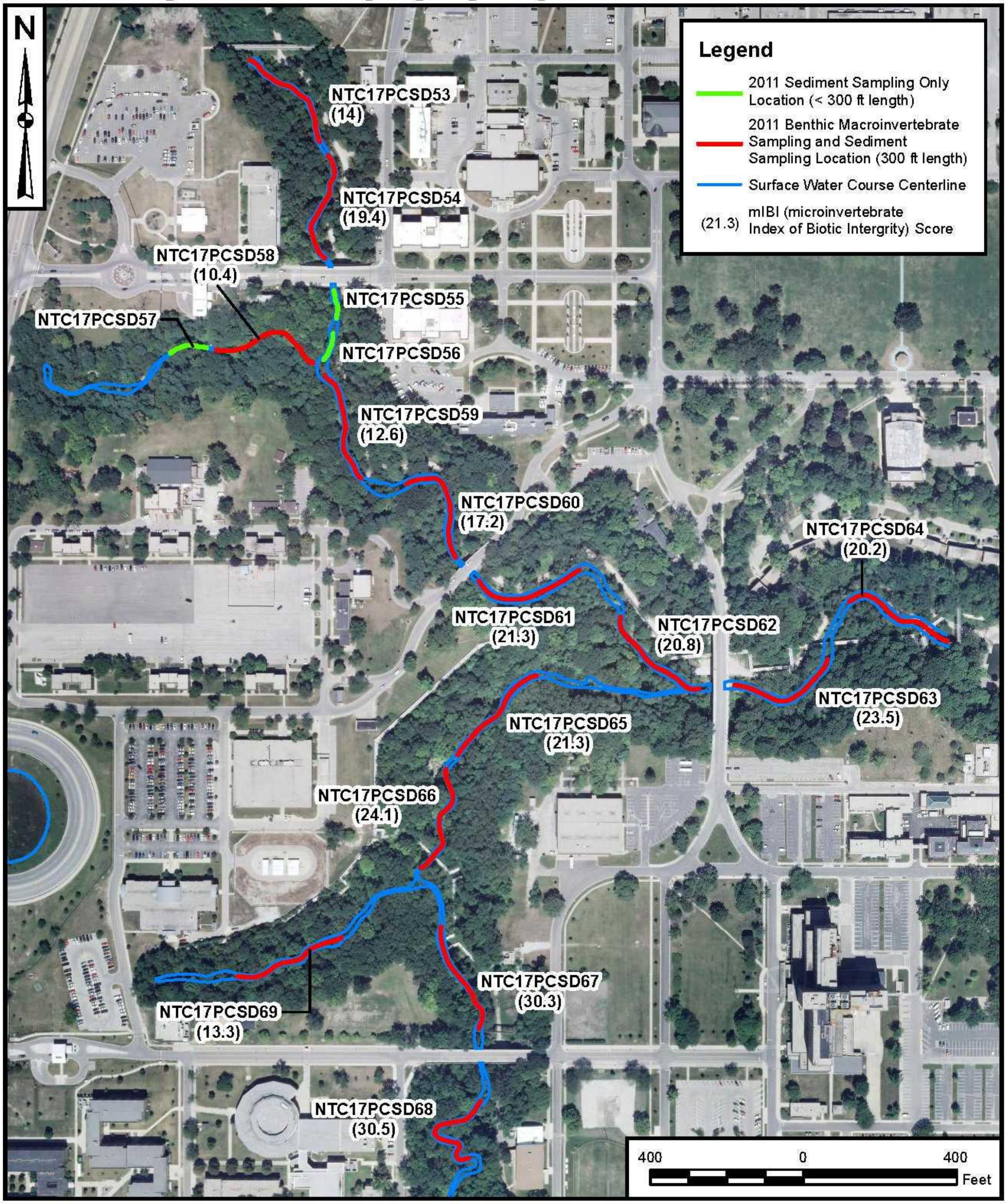

Figure 9. Site location map. Benthic sampling locations include scores for the mIBI in parentheses.

In the downstream half of the North Branch (test), index scores were similar to those in the downstream reference site samples (South Branch). Habitat quality in the downstream test sites is similar to habitat quality in the reference sites. Without examining sediment chemistry and water quality, we might expect that the downstream reference and test sites would have similar biological conditions, as observed. In the upper portions of the channels, the water sources and legacy sediment conditions may differ and habitat conditions are somewhat better in reference areas. The upper reference channel has “Fair” biological conditions. “Good” or “Exceptional” conditions may not be attained because of ambient urban stressors, such as nutrients and toxicants in runoff and altered hydrology due to imperviousness in the watershed. Nutrient and hydrological stressors were not evaluated in this study, so we can only assume that they are in effect based on predominant land uses and imperviousness that are commonly associated with them.

Based on the sediment chemistry results, concentrations of contaminants (primarily PAHs and metals such as copper, lead, and zinc) are generally higher in the test sites compared to reference sites. These contaminants may contribute to community stress at multiple trophic levels including the benthic macroinvertebrates. An evaluation of the contaminant concentrations and their correlation with biological measures will be conducted in the primary report for Site 17. The mIBI and other metrics that show variability among sites (Total Taxa, EPT percent, Scraper percent, the MBI, and possibly density) should be included in the analysis.

The habitat conditions in the sites with the worst mIBI scores are noted as “scoured to the silt/clay layer” in the field notes (test SD58 and SD 59 and reference SD65 and 66; Tables 1 and 4). Scouring removes or disturbs stable substrate on which benthic macroinvertebrates are able to live, and the silt/clay hardpan is mostly uninhabitable. Whereas excessive fine sediments can be a problem with clogging interstitial spaces in some streams, the lack of fine sediments can also reduce habitat suitability (Brown and Brussock, 1991). Channels that are scoured down to an armored layer such as hardpan or bedrock do not provide suitable surface and interstitial area to support a healthy benthic assemblage. These conditions are common below the spillways of dams, where high flows and low sediment supply are common (Novotny, 1985). Scouring of the Pettibone Creek channel has led to degradation of habitat conditions. The habitat quality, as measured by the QHEI, was positively related to the percentage of fine particles in the sites, suggesting that one of the major habitat stressors is the high storm flows with channel scouring effects.

Channel morphology is related to stream power (Montgomery and Buffington, 1997; Nanson and Hicken, 1986). Where the channel is scoured, the banks are also eroded, indicating that the stream power is capable of moving greater loads than are available from upstream. Bank erosion provides one source of sediments to the powerful currents.

Restoration activity in the North Branch of Pettibone Creek could include removal of contaminated substrates and replacement with clean substrate. While this would undoubtedly result in reduction in contaminants at the restoration sites, there are reasons to reconsider this solution. First, removal of contaminants alone is not likely to have a great effect towards restoring biological integrity because it is evident that physical habitat conditions are at least partially limiting biological potential. Second, substantial study and effort would be required to prevent further degradation of habitat conditions after channel disturbance for restoration. In the sediment-starved system, replaced substrate would need to be carefully planned by a channel morphologist and an ecologist so that all the considerations of erosive forces and habitat quality could be balanced. Replacement with armored substrate to prevent down-cutting and entrenchment may not improve habitat conditions for macroinvertebrates. In other words, this end-of-pipe environment is a harsh habitat that would be impractical to restore to natural conditions and restoration to morphologically stable stream conditions may not benefit the biological community. One relatively simple step that could be taken to improve habitat conditions and channel morphology would be to refrain from removing woody debris that falls into the stream channel and along the banks. Woody debris in the stream increases channel roughness, which in turn reduces flow velocity (Buffington and

Montgomery, 1999). The woody debris also increases habitat complexity and provides stable, inhabitable substrate for specialized macroinvertebrates, including serving as a nutritional source for some. In any case, the physical, chemical, biological, and political goals for restoration should be carefully coordinated and measures to gage eventual project success should be established as restoration activities are planned (Palmer et al., 2005, Palmer, 2008).

Conditions in the South Branch of Pettibone Creek could be considered a target for restoration because habitat and sediment chemistry conditions are somewhat better than in the North Branch. These conditions may be due to land uses in the South Branch watershed that are less industrial with less impervious surfaces compared to the watershed of the North Branch. Industrial uses are probably associated with contaminant concentrations and imperviousness can contribute to extreme flows conditions. The North Branch physical and sediment chemistry conditions may be restorable to conditions similar to the South Branch, resulting in incremental improvement of the biological conditions from generally “Poor” to generally “Fair”. It should be noted that the overall goal should be at least “Good” in both channels of Pettibone Creek. “Good” conditions are attainable in the region, as seen in the samples collected by Illinois EPA (Table 6). However, the intensely urban setting of this basin is only comparable to one of the Illinois EPA samples (Pike Creek), in which the mIBI score was similar to those of Pettibone Creek.

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Appendix A

Field Data Sheets

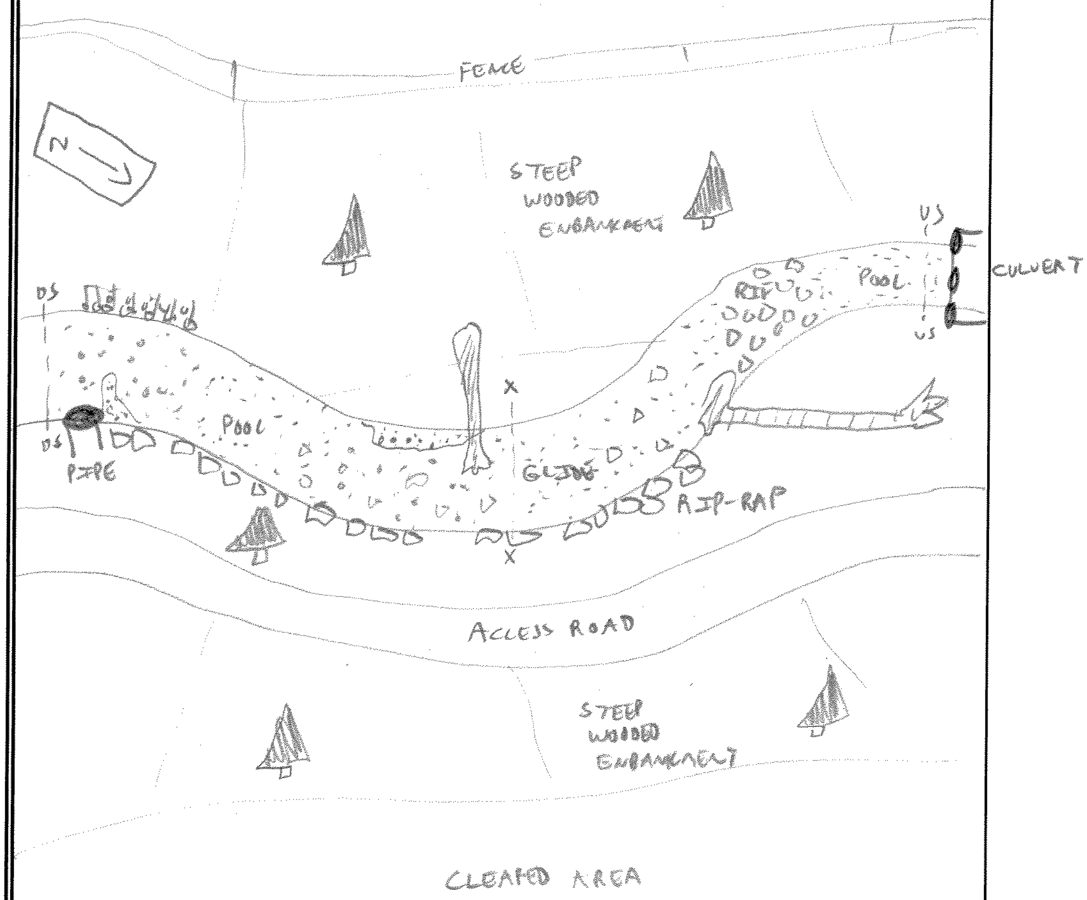
cb

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES
STATION # NTC17PCSD53	Latitude 42.31345
PHOTO #	Longitude 087.84277
INVESTIGATORS CB, BR, KS	
FORM COMPLETED BY CB	DATE 03-28-2012 / REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** ☐ ☐ ☐ ☐ ____% ☑ — **Past 24 hours** ☐ storm (heavy rain) ☐ rain (steady rain) ☐ showers (intermittent) ☑ 20 % cloud cover ☐ clear/sunny	**Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 65 ° ~~C~~ F **Other**______

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☑ Other MILITARY BASE
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Canopy Cover
☐ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark 1.3 m

Local Water Erosion
☐ None ☐ Moderate ☑ Heavy

Estimated Stream Width 3.0 m

Estimated Stream Depth
☑ Riffle 0.10 m ☐ Run ______ m
☑ Pool 0.40 m

Velocity 1m = 11s ~~m/sec~~

Estimated Reach Length 300 FT ~~m~~

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present DECIDUOUS

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating
☐ Floating Algae ☑ Attached Algae

dominant species present UNKNOWN

Portion of the reach with vegetative cover 70 %

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☑ None
☐ Other ______

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☐ Other ______

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

WATER QUALITY

Temperature 11.40 °C

Specific Conductance 1.29 ms/cm

Dissolved Oxygen 11.61 mg/L

pH 7.98

Turbidity 13.0 NTU

WQ Instrument Used HORIBA

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☑ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other ______

Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Water color ☐ Other ______

cB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD53	
Reference or test? TEST		
FORM COMPLETED BY CB	DATE 03-28-2012 TIME 1600	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 45 % ☑ Snags 15 % UNDERCUT - 15 ☐ Vegetated Banks ____ % ☑ Sand 15 % ☐ Submerged Macrophytes ____ % ☑ Other (ROOTWADS) 10 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH < 10 FEET -> 10 BOTTOM, 10 BANK. BOTTOM: COARSE - ~~IIII~~ IIII; FINE - III; DETRITUS - BANK: SNAGS - III; ROOTWADS - II; UNDERCUT - III REACH IS DOWNSTREAM OF CULVERT.

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — QHEI Score: 54

Stream & Location: PETTIBONE CREEK **RM:** ___ **Date:** 03/28/2012
NTC17PCS053 **Scorers Full Name & Affiliation:**
River Code: - - **STORET #:** **Lat./Long.:** /8 . Office verified location ☑

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES (POOL RIFFLE): ☐☐ BLDR /SLABS [10]; ☐☐ BOULDER [9]; ☐☑ COBBLE [8]; ☐☐ GRAVEL [7]; ☑☐ SAND [6]; ☐☐ BEDROCK [5]

OTHER TYPES (POOL RIFFLE): ☐☐ HARDPAN [4]; ☐☐ DETRITUS [3]; ☐☐ MUCK [2]; ☐☐ SILT [2]; ☐☐ ARTIFICIAL [0] (Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

ORIGIN *: ☐ LIMESTONE [1]; ☑ TILLS [1]; ☐ WETLANDS [0]; ☐ HARDPAN [0]; ☐ SANDSTONE [0]; ☑ RIP/RAP [0]; ☐ LACUSTURINE [0]; ☐ SHALE [-1]; ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2]; ☐ MODERATE [-1]; ☑ NORMAL [0]; ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2]; ☑ MODERATE [-1]; ☐ NORMAL [0]; ☐ NONE [1]

Comments — Substrate 13.5 (Maximum 20)

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]; 0 OVERHANGING VEGETATION [1]; 2 SHALLOWS (IN SLOW WATER) [1]; 0 ROOTMATS [1]; 1 POOLS > 70cm [2]; 1 ROOTWADS [1]; 1 BOULDERS [1]; 0 OXBOWS, BACKWATERS [1]; 0 AQUATIC MACROPHYTES [1]; 1 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11]; ☐ MODERATE 25-75% [7]; ☑ SPARSE 5-<25% [3]; ☐ NEARLY ABSENT <5% [1]

Comments — Cover 10 (Maximum 20)

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4]; ☐ MODERATE [3]; ☑ LOW [2]; ☐ NONE [1]
DEVELOPMENT: ☐ EXCELLENT [7]; ☐ GOOD [5]; ☐ FAIR [3]; ☑ POOR [1]
CHANNELIZATION: ☐ NONE [6]; ☐ RECOVERED [4]; ☐ RECOVERING [3]; ☑ RECENT OR NO RECOVERY [1]
STABILITY: ☐ HIGH [3]; ☑ MODERATE [2]; ☐ LOW [1]

Comments — Channel 6 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) River right looking downstream

EROSION (L R): ☐☑ NONE / LITTLE [3]; ☑☐ MODERATE [2]; ☐☐ HEAVY / SEVERE [1]
RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4]; ☐☑ MODERATE 10-50m [3]; ☐☐ NARROW 5-10m [2]; ☑☐ VERY NARROW < 5m [1]; ☐☐ NONE [0]
FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3]; ☐☐ SHRUB OR OLD FIELD [2]; ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]; ☐☐ FENCED PASTURE [1]; ☐☐ OPEN PASTURE, ROWCROP [0]; ☐☐ CONSERVATION TILLAGE [1]; ☑☑ URBAN OR INDUSTRIAL [0]; ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments — Riparian 4.5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!): ☐ > 1m [6]; ☑ 0.7-<1m [4]; ☐ 0.4-<0.7m [2]; ☐ 0.2-<0.4m [1]; ☐ < 0.2m [0]
CHANNEL WIDTH Check ONE (Or 2 & average): ☑ POOL WIDTH > RIFFLE WIDTH [2]; ☐ POOL WIDTH = RIFFLE WIDTH [1]; ☐ POOL WIDTH > RIFFLE WIDTH [0]
CURRENT VELOCITY Check ALL that apply: ☐ TORRENTIAL [-1]; ☐ VERY FAST [1]; ☐ FAST [1]; ☑ MODERATE [1]; ☑ SLOW [1]; ☐ INTERSTITIAL [-1]; ☐ INTERMITTENT [-2]; ☐ EDDIES [1] — Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments — Pool / Current 8 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2]; ☐ BEST AREAS 5-10cm [1]; ☑ BEST AREAS < 5cm [metric=0]
RUN DEPTH: ☐ MAXIMUM > 50cm [2]; ☑ MAXIMUM < 50cm [1]
RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2]; ☑ MOD. STABLE (e.g., Large Gravel) [1]; ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]
RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2]; ☐ LOW [1]; ☑ MODERATE [0]; ☐ EXTENSIVE [-1]

Comments — Riffle / Run 2 (Maximum 8)

6] GRADIENT (10.0 ft/mi) ☐ VERY LOW - LOW [2-4]; ☑ MODERATE [6-10]; ☐ HIGH - VERY HIGH [10-6]
DRAINAGE AREA (mi²)

%POOL: 20 %GLIDE: 60 %RUN: 0 %RIFFLE: 10

Gradient 10 (Maximum 10)

EPA 4520 06/16/06

* ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE AND SITE OBSERVATION.

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD 53 | **DATE:** 2012-03-28 (YYYY-MM-DD)

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	G	29	33	SC	57	50	VC	61	40	55	C
2	RN	SB	21	43	63	21	75	28	21	28	10
3	P	12	MB	MC	40	45	33	62	24	47	C
4	RN	VF	MC	MC	50	VC	MC	10	VC	VC	M
5	G	31	18	30	19	53	VC	100	13	22	C
6	P	M	60	MB	90	SB	110	45	30	80	VF
7	RN	22	28	SmC	30	60	34	22	24	SmC	F
8	RF	SmC	SmC	SmC	33	55	100	12	80	43	5
9	RN	45	17	35	SmC	SmC	LC	MC	MC	VC	VC
10	RN	8	MC	40	MC	45	40	60	45	120	48

MB = Med. Boulder

SB = Small Boulder

SmC = Small Cobble

LC = Large Cobble

MC = Med. Cobble

Abbreviations:

Silt/Clay = SC
Sand – Very Fine = VF
Sand – Fine = F
Sand – Medium = M
Hardpan Clay – = HP
Bedrock – BR = BR
Sand – Coarse = C
Sand – Very = VC
Small Boulder = SB
Medium = MB
Large Boulder = LB

Feature Types:

Riffle = RF
Run = RN
Glide = G
Pool = P

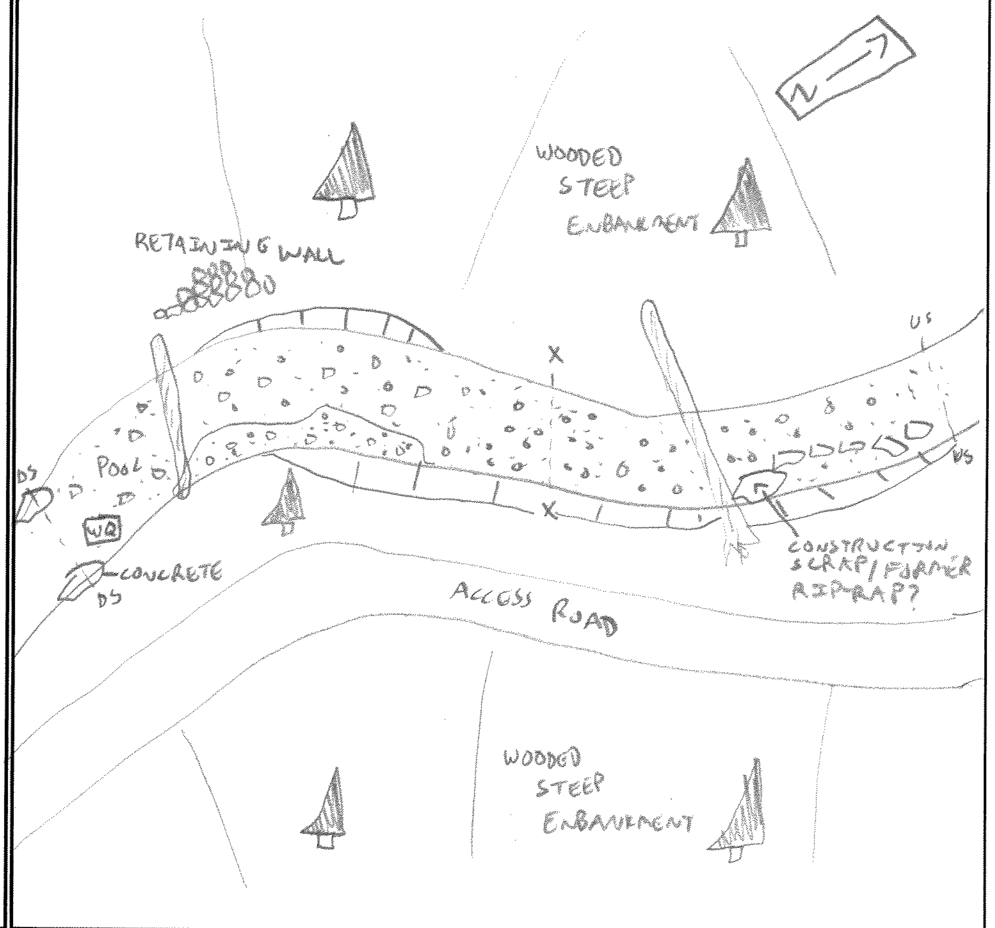
After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

cb

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17 PCSD54	Latitude 42.31257	
PHOTO #	Longitude 087.84241	
INVESTIGATORS CB, BR, KS		
FORM COMPLETED BY CB	DATE 03-28-2012	REASON FOR SURVEY

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled 
STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal **Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ ☐ storm (heavy rain) ☐ ☐ rain (steady rain) ☐ ☐ showers (intermittent) ☐ ____% ☑ 20 %cloud cover ☑ ☐ clear/sunny **Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 65 ° ~~C~~ F **Other** ________

cb

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded **High Water Mark** 1.5 m	**Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 3.1 m **Estimated Stream Depth** ☑ Riffle 0.10 m ☑ Run 0.25 m ☑ Pool 0.45 m **Velocity** 1m=7s m/sec **Estimated Reach Length** 300 m FT **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 40 %	
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 12.33 °C **Specific Conductance** 1.47 ms/cm **Dissolved Oxygen** 12.68 mg/L **pH** 7.99 **Turbidity** 14.2 NTU **WQ Instrument Used** HORIBA	**Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____ **Water Surface Oils** ☐ Slick ☑ Sheen ☐ Globs ☑ Flecks ☐ None ☐ Other____ **Turbidity (if not measured)** ☐ Clear ☑ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other____

CP

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD54	
Reference or test? TEST		
FORM COMPLETED BY CB	DATE 03-28-2012 TIME 1430	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 45 % ☑ Snags 15 % ROOTWAD - 25 ☐ Vegetated Banks ____ % ☑ Sand 10 % ☐ Submerged Macrophytes ____ % ☐ Other (DETRITUS) 5 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH < 10 FT → 10 BOTTOM, 10 BANK BOTTOM: COARSE - ~~IIII~~ IIII; FINE - II; DETRITUS - I BANK: SNAG - III; ROOTWAD - ~~IIII~~ REASONABLY SHALLOW THROUGHOUT REACH.

OhioEPA — **Qualitative Habitat Evaluation Index and Use Assessment Field Sheet** — **QHEI Score: 49.5**

Stream & Location: PETTIBONE CREEK **RM:** _ _ . _ **Date:** 02/28/08 2012

NTC17PCSD54 **Scorers Full Name & Affiliation:**

River Code: _ - _ - _ **STORET #:** **Lat./Long.:** (NAD 83 - decimal °) _ . _ /8 _ . _ Office verified location ☑

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]	1		☐☐ DETRITUS [3]	1	
☐☑ COBBLE [8]	1	1	☐☐ MUCK [2]		
☐☐ GRAVEL [7]	1	1	☐☐ SILT [2]		
☑☐ SAND [6]	1	1	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN *	QUALITY
☐ LIMESTONE [1]	SILT: ☐ HEAVY [-2]
☑ TILLS [1]	☐ MODERATE [-1]
☐ WETLANDS [0]	☑ NORMAL [0]
☐ HARDPAN [0]	☐ FREE [1]
☐ SANDSTONE [0]	EMBEDDEDNESS: ☐ EXTENSIVE [-2]
☑ RIP/RAP [0]	☐ MODERATE [-1]
☐ LACUSTURINE [0]	☑ NORMAL [0]
☐ SHALE [-1]	☐ NONE [1]
☐ COAL FINES [-2]	

Substrate 14.5 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]	0 POOLS > 70cm [2]	0 OXBOWS, BACKWATERS [1]
1 OVERHANGING VEGETATION [1]	1 ROOTWADS [1]	0 AQUATIC MACROPHYTES [1]
1 SHALLOWS (IN SLOW WATER) [1]	1 BOULDERS [1]	1 LOGS OR WOODY DEBRIS [1]
0 ROOTMATS [1]		

AMOUNT — Check ONE (Or 2 & average)
☐ EXTENSIVE >75% [11]
☐ MODERATE 25-75% [7]
☑ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover 8 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☑ LOW [1]
☐ NONE [1]	☐ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel 7 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☑ MODERATE [2]	☐☑ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☑☑ URBAN OR INDUSTRIAL [0]
☑☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☑☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian 3 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)	CHANNEL WIDTH — Check ONE (Or 2 & average)	CURRENT VELOCITY — Check ALL that apply	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☑ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 6 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run 1 Maximum 8

6] GRADIENT (10.0 ft/mi)
DRAINAGE AREA (mi²)

☐ VERY LOW - LOW [2-4]
☐ MODERATE [6-10]
☐ HIGH - VERY HIGH [10-6]

%POOL: 30 %GLIDE: 55
%RUN: 5 %RIFFLE: 10

Gradient 10 Maximum 10

EPA 4520 06/16/06

*-ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS

Reviewed By: [illegible]

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

03 3 MAR 28

SITE ID: NTC17PCSD 54 | **DATE:** 20 12-28-28 (YYYY-MM-DD)

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	G	6	8	13	10	36	12	14	VC	7	VC
2	P	F	M	21	75	28	100	MC	HP	HP	HP
3	RF	42	50	28	45	55	47	30	41	33	43
4	RF	15	44	50	47	22	63	57	29	50	44
5	RN	VC	25	13	43	19	80	36	71	25	C
6	G	VC	15	43	43	52	55	14	50	55	30
7	~~[illegible]~~ P	VC	8	45	20	23	20	60	60	48	17
8	RN	72	70	46	60	38	55	43	33	23	33
9	RF	HP	HP	SC	MC	LC	81	48	55	79	75
10	P	HP	100	M	12	32	M[illegible]	48	14	88	81

MC = Med Cobble

LC = Large Cobble

Abbreviations:

Silt/Clay	= SC	Sand – Coarse	= C
Sand – Very Fine	= VF	Sand – Very	= VC
Sand – Fine	= F	Small Boulder	= SB
Sand – Medium	= M	Medium	= MB
Hardpan Clay –	= HP	Large Boulder	= LB
Bedrock – BR	= BR		

Feature Types:

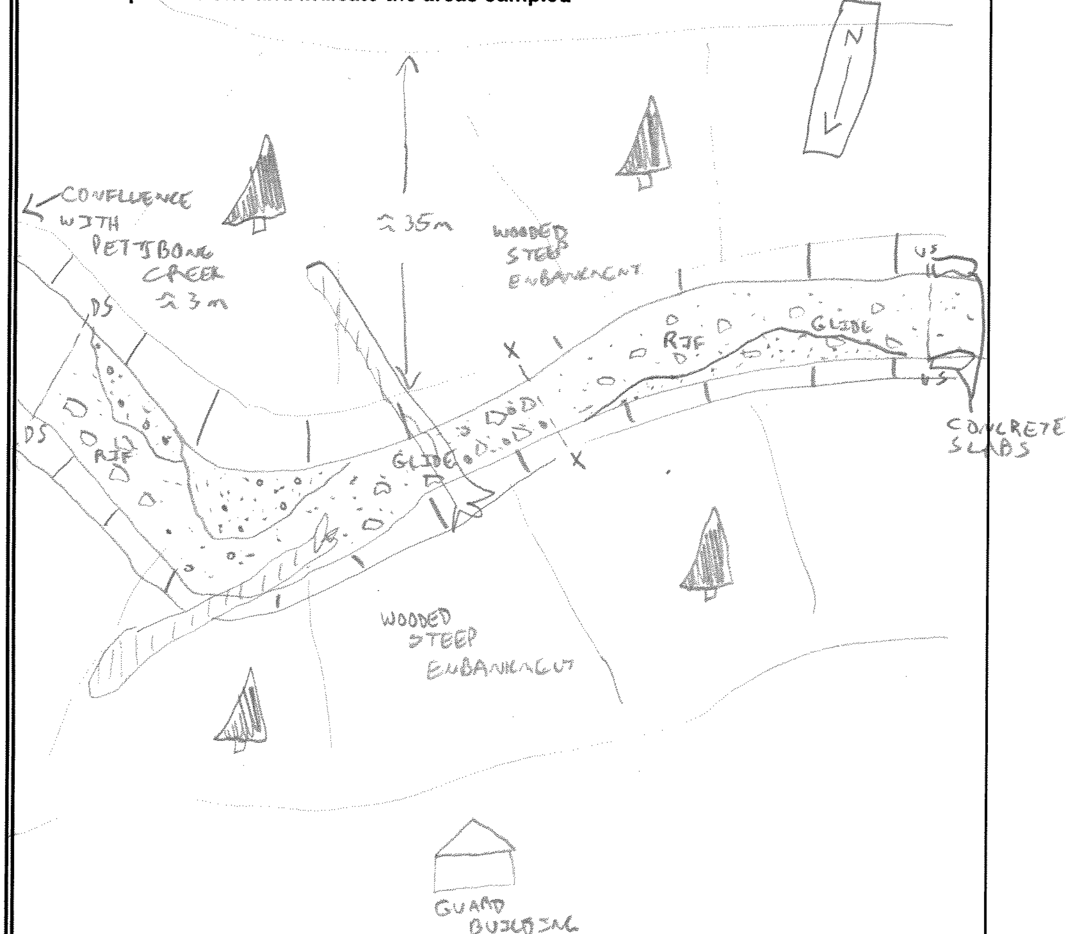
Riffle	= RF
Run	= RN
Glide	= G
Pool	P

After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME ~~PETTIBONE~~ CREEK	LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17PCS058	Latitude 42.31170	
PHOTO #	Longitude 087.84308	
INVESTIGATORS CB, BR, KS		
FORM COMPLETED BY CB	DATE 03-29-2012	REASON FOR SURVEY

SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled** 
STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal **Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ ☐ storm (heavy rain) ☐ ☐ rain (steady rain) ☐ ☐ showers (intermittent) ☐____% ☐____%cloud cover ☑ ☑ clear/sunny **Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 44 ° ~~C~~F **Other**________________

cB

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** 1.3* m *-DIFFICULT TO DETERMINE DUE TO EROSION.	**Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 2.0 m **Estimated Stream Depth** ☑ Riffle 0.10 m ☑ Run 0.20 m ☑ Pool 0.46 m **Velocity** 1m:4s ~~m/sec~~ **Estimated Reach Length** 300 FT. ~~m~~ **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 80 %	
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 10.04 °C **Specific Conductance** 2.21 mS/cm **Dissolved Oxygen** 11.36 mg/L **pH** 7.78 **Turbidity** 7.5 NTU **WQ Instrument Used** HORIBA	**Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____ **Water Surface Oils** ☐ Slick ☑ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other____ **Turbidity (if not measured)** ☑ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other____

CB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD58	
Reference or test? TEST		
FORM COMPLETED BY CB	DATE 03-29-2013 TIME 0815	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 30 % ☑ Snags 25 % ROOTWAD - 15% ☐ Vegetated Banks ____ % ☑ Sand 25 % ☐ Submerged Macrophytes ____ % ☐ Other (DETRITUS) 5 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH < 10 FT → 10 BOTTOM, 10 BANK BOTTOM: COARSE - ~~IIII~~ I; FINE - ~~IIII~~; DETRITUS - I BANK: SNAG - ~~IIII~~; ROOTWAD - III REACH LOCATED IN NARROW V-SHAPED VALLEY WITH HEAVILY ERODED BANKS. AREAS OF REACH ARE SCOURED DOWN TO SILTY-CLAY LAYER.

Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — **QHEI Score: 49.5**

Stream & Location: NTC17PCS058 **RM:** ___ **Date:** 03/21/~~08~~ 2012

Scorers Full Name & Affiliation: C. BARBOUR

River Code: __ **STORET #:** __ **Lat./Long.:** __ /8__ Office verified location ☑

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☐☐ MUCK [2]		
☐☑ GRAVEL [7]			☐☐ SILT [2]		
☑☐ SAND [6]			☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☐ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN *: ☐ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☑ RIP/RAP [0] ☐ LACUSTRINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Comments

Substrate: 12.5 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 0 UNDERCUT BANKS [1]
- 0 OVERHANGING VEGETATION [1]
- 2 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 0 POOLS > 70cm [2]
- 1 ROOTWADS [1]
- 1 BOULDERS [1]
- 1 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 2 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☐ MODERATE 25-75% [7] ☑ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 8 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☑ RECOVERING [3]	☑ LOW [1]
☐ NONE [1]	☑ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel: 7 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☑☑ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☑☑ URBAN OR INDUSTRIAL [0]
☑☑ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian: 4 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☑ 0.4-<0.7m [2]	☐ POOL WIDTH > RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 6 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 2 (Maximum 8)

6] GRADIENT
GRADIENT (10.0 ft/mi) DRAINAGE AREA (mi²)

☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: 20 %GLIDE: 50 %RUN: 10 %RIFFLE: 20

Gradient: 10 (Maximum 10)

EPA 4520 06/16/06

* - ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD 59 | **DATE:** 2012-03-29 (YYYY-MM-DD)

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	RF	SC	12	21	16	38	15	16	7	VC	M
2	P	SC	VC	15	SC	SC	SC	SC	MC	28	17
3	P	HP	HP	HP	HP	HP	SC	VC	SC	SC	VF
4	RF	21	48	32	SC*	7	35	22	60	90	10
5	P	SC	20	30	14	28	15	43	55	34	65
6	P	M	24	35	13	5	C	HP	HP	HP	HP
7	RF	50	48	35	48	10	90	100	62	30	12
8	RF	6	15	VC	48	110	28	60	24	40	32
9	RN	45	11	25	32	30	22	31	22	20	SC
10	G	8	5	6	6	18	8	18	15	F	MC

*SMALL COBBLE

MC = Med. Cobble

Abbreviations:

Silt/Clay = SC
Sand – Very Fine = VF
Sand – Fine = F
Sand – Medium = M
Hardpan Clay – = HP
Bedrock – BR = BR
Sand – Coarse = C
Sand – Very = VC
Small Boulder = SB
Medium = MB
Large Boulder = LB

Feature Types:

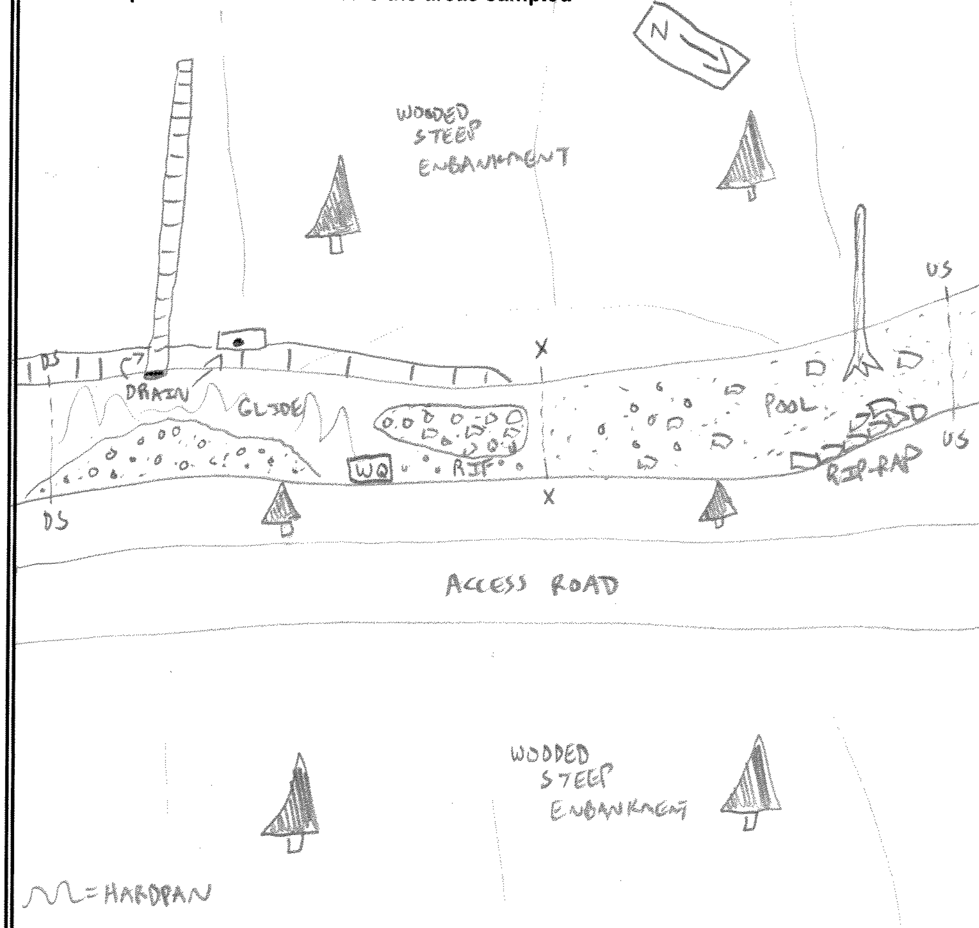
Riffle = RF
Run = RN
Glide = G
Pool = P

After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17PCSD59	Latitude 42.31096	
PHOTO #	Longitude 087.84235	
INVESTIGATORS CB, BA, KS		
FORM COMPLETED BY CB	DATE 03-28-2012	REASON FOR SURVEY

SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled**  	
STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ / ☐ storm (heavy rain) ☐ / ☐ rain (steady rain) ☐ / ☐ showers (intermittent) ☐ ____% / ☑ 20 % cloud cover ☑ / ☐ clear/sunny	**Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 65 °F **Other** ________

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded **High Water Mark** 1.7 m **Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 7.5 m **Estimated Stream Depth** ☑ Riffle 0.10 m ☐ Run ____ m ☑ Pool 0.50 m **Velocity** 1m=45 ~~m/sec~~ **Estimated Reach Length** 300 ~~m~~ FT **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 60 %
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other ____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 14.23 °C **Specific Conductance** 1.65 ms/cm **Dissolved Oxygen** 14.90 mg/L **pH** 8.00 **Turbidity** 7.1 NTU **WQ Instrument Used** HORIBA **Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☑ None ☐ Other ____ **Turbidity (if not measured)** ☐ Clear ☑ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other ____

cB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD59	
Reference or test? TEST		
FORM COMPLETED BY cB	DATE 03-28-2012 TIME 1215	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 30 % ☑ Snags 20 % ROOTWAD - 15 ❑ Vegetated Banks ____ % ☑ Sand 25 % ❑ Submerged Macrophytes ____ % ❑ Other (DETRITUS) 10 %
SAMPLE COLLECTION	**How were the samples collected?** ❑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble ____ ❑ Snags ____ ❑ Vegetated Banks ____ ❑ Sand ____ ❑ Submerged Macrophytes ____ ❑ Other ( ) ____
GENERAL COMMENTS	WIDTH GREATER THAN 10 FT → 12 BOTTOM, 8 BANK BOTTOM: COARSE - ~~IIII~~ I; FINE - ~~IIII~~; DETRITUS - II BANK: SNAGS - IIII; ROOTWADS - III HIGH LEVEL OF BANK EROSION. PORTION OF REACH SCOURED TO HARDPAN.

Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 49.5

Stream & Location: PETTIBONE CREEK **RM:** _ _ . _ **Date:** 03/28/2012

NTC17 PCSD 59 **Scorers Full Name & Affiliation:**

River Code: - - **STORET #:** **Lat/Long.:** /8 . **Office verified location** ☐

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR/SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☐☐ MUCK [2]		
☐☑ GRAVEL [7]			☐☐ SILT [2]		
☑☐ SAND [6]			☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

ORIGIN * (Check ONE (Or 2 & average)): ☐ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☑ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate: 12.5 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
1 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
1 POOLS > 70cm [2]
1 ROOTWADS [1]
1 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☐ MODERATE 25-75% [7] ☑ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 10 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☑ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☐ FAIR [3] ☑ POOR [1]

CHANNELIZATION: ☐ NONE [6] ☐ RECOVERED [4] ☐ RECOVERING [3] ☑ RECENT OR NO RECOVERY [1]

STABILITY: ☐ HIGH [3] ☐ MODERATE [2] ☑ LOW [1]

Comments

Channel: 5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3] ☐☑ MODERATE [2] ☑☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4] ☐☑ MODERATE 10-50m [3] ☐☐ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☑☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☑☑ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 3 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!)): ☐ > 1m [6] ☑ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH (Check ONE (Or 2 & average)): ☑ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY (Check ALL that apply): ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]
Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 8 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☐ LOW [1] ☑ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 1 (Maximum 8)

6] GRADIENT
GRADIENT (10.0 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 60 %GLIDE: 25 %RUN: 5 %RIFFLE: 10

Gradient: 10 (Maximum 10)

EPA 4520 06/16/06

* - ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS.

Reviewed By: cB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD59		DATE: 2012-03-28 (YYYY-MM-DD)									
		Grabs									
Transect	Feature Type	1	2	3	4	5	6	7	8	9	10
1	RF	43	42	17	34	MC	MC	MC	SB	LC	11
2	G	13	HP	24	27	HP	HP	HP	HP	HP	HP
3	RN	20	9	17	C	14	HP	HP	HP	HP	HP
4	RF	22	75	150	22	17	43	48	41	35	26
5	RF	6	9	24	70	46	35	17	46	100	29
6	G	SC	23	M	32	33	21	C	C	M	100
7	G	VF	C	C	C	22	5	C	6	VF	VF
8	P	LB	100	80	VF	9	11	6	M	M	HP
9	P	LB	SC#	SC#	M	14	VF	M	M	M	M
10	P	SC	SC	17	VF	8	12	HP	HP	SC	SC

LB = LARGE BOULDE

SC# = Small Cobble (Too deep to measure)

Abbreviations:

Silt/Clay	= SC	Sand – Coarse	= C
Sand – Very Fine	= VF	Sand – Very	= VC
Sand – Fine	= F	Small Boulder	= SB
Sand – Medium	= M	Medium	= MB
Hardpan Clay –	= HP	Large Boulder	= LB
Bedrock – BR	= BR		

Feature Types:

Riffle	= RF
Run	= RN
Glide	= G
Pool	= P

After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

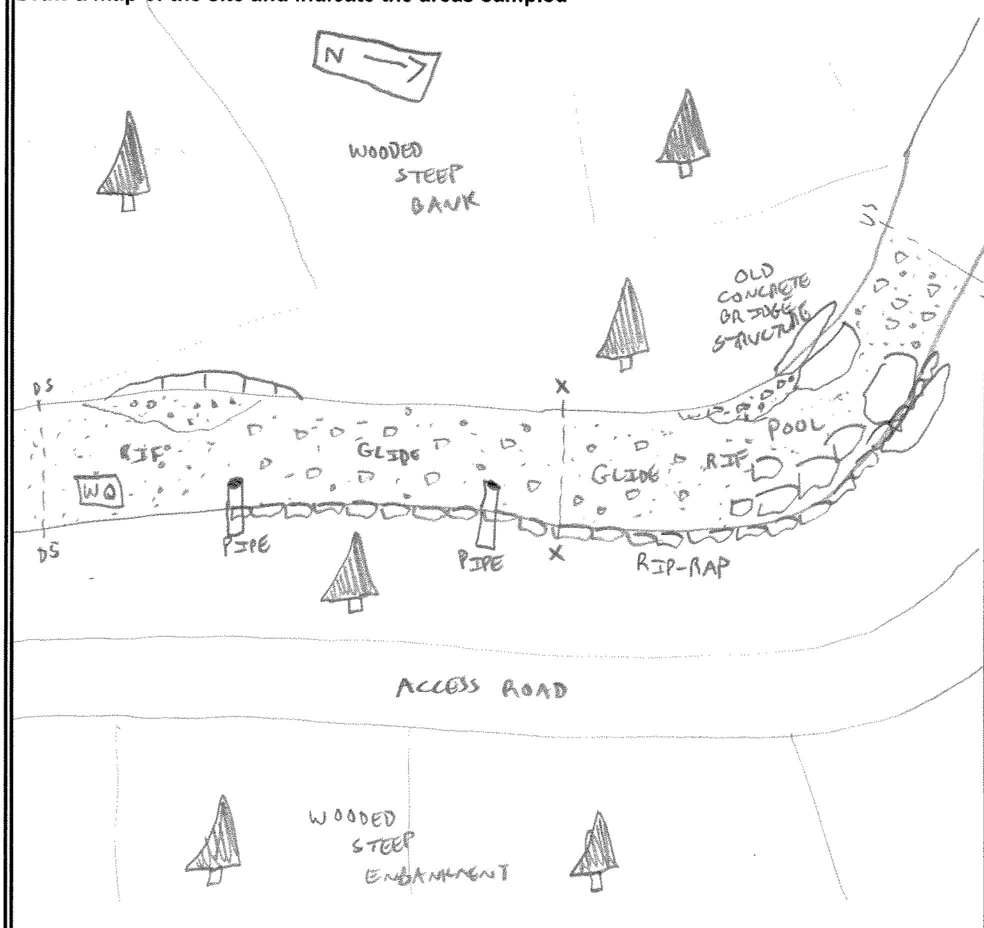
FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES
STATION # NTC17PCSD60	Latitude 42.31050
PHOTO #	Longitude 087.84132
INVESTIGATORS CB, BR, KS	

FORM COMPLETED BY	DATE	REASON FOR SURVEY
CB	03-28-2012	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION

Subsystem Classification
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

WEATHER CONDITIONS

Now	Past 24 hours	
☐	☐	storm (heavy rain)
☐	☐	rain (steady rain)
☐	☐	showers (intermittent)
☐ ____%	☑ 20	%cloud cover
☑	☐	clear/sunny

Has there been a heavy rain in the last 7 days?
☑ Yes ☐ No

Air Temperature 60 °F

Other________________

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** 1.8 m **Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 3.1 m **Estimated Stream Depth** ☑ Riffle 0.10 m ☑ Run 0.35 m ☑ Pool 0.70 m **Velocity** 1m:65 ~~m/sec~~ **Estimated Reach Length** 300 ~~m~~ FT **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** UNKNOWN
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 80 %
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ______ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 10.59 °C **Specific Conductance** 1.73 ms/cm **Dissolved Oxygen** 13.06 mg/L **pH** 7.85 **Turbidity** 8.2 NTU **WQ Instrument Used** HORIBA **Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☑ None ☐ Other ______ **Turbidity (if not measured)** ☐ Clear ☑ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other ______

CP

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17 PCSD60	
Reference or test? TEST		
FORM COMPLETED BY CB	DATE 03-28-2012 TIME 1000	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 50 % ☑ Snags 10 % ❑ Vegetated Banks ____ % ☑ Sand 25 % ❑ Submerged Macrophytes ____ % ☑ Other (ROOTWADS) 15 %
SAMPLE COLLECTION	**How were the samples collected?** ❑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble ____ ❑ Snags ____ ❑ Vegetated Banks ____ ❑ Sand ____ ❑ Submerged Macrophytes ____ ❑ Other ( ) ____
GENERAL COMMENTS	WIDTH <10 FT → 10 SUBSTRATE + 10 BANK BOTTOM COARSE - ~~||||~~ ~~||||~~ FINE - ~~||||~~ DETRITUS - BANK - SNAG - II ROOTWADS - III

Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — **QHEI Score:** 59.5

Stream & Location: PETTIBONE CREEK **RM:** ___ **Date:** 03/28/06

NTC17PCSD60 **Scorers Full Name & Affiliation:**

River Code: - - **STORET #:** **Lat./ Long.:** . /8 . Office verified location ☑

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE	ORIGIN *	QUALITY
☐☐ BLDR /SLABS [10]	1	1	☐☐ HARDPAN [4]			☐ LIMESTONE [1]	SILT: ☐ HEAVY [-2]
☐☐ BOULDER [9]	1	1	☐☐ DETRITUS [3]			☑ TILLS [1]	☐ MODERATE [-1]
☐☑ COBBLE [8]	1	1	☐☐ MUCK [2]			☐ WETLANDS [0]	☑ NORMAL [0]
☑☐ GRAVEL [7]	1	1	☐☐ SILT [2]			☐ HARDPAN [0]	☐ FREE [1]
☑☐ SAND [6]	1	1	☐☐ ARTIFICIAL [0]			☐ SANDSTONE [0]	EMBEDDEDNESS: ☐ EXTENSIVE [-2]
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)			☑ RIP/RAP [0]	☑ MODERATE [-1]
						☐ LACUSTURINE [0]	☐ NORMAL [0]
						☐ SHALE [-1]	☐ NONE [1]
						☐ COAL FINES [-2]	

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

Substrate: 14 — Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1	UNDERCUT BANKS [1]	1	POOLS > 70cm [2]	0	OXBOWS, BACKWATERS [1]
0	OVERHANGING VEGETATION [1]	1	ROOTWADS [1]	0	AQUATIC MACROPHYTES [1]
2	SHALLOWS (IN SLOW WATER) [1]	1	BOULDERS [1]	1	LOGS OR WOODY DEBRIS [1]
0	ROOTMATS [1]				

AMOUNT — Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☑ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 10 — Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel: 8 — Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average). River right looking downstream.

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☑ NONE / LITTLE [3]	☐☑ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☐☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☑☑ URBAN OR INDUSTRIAL [0]
☑☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☑☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian: 4.5 — Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)	CHANNEL WIDTH — Check ONE (Or 2 & average)	CURRENT VELOCITY — Check ALL that apply	
☑ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH > RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 10 — Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☑ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☐ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 3 — Maximum 8

6] GRADIENT (10.0 ft/mi) DRAINAGE AREA (mi²)
- ☐ VERY LOW - LOW [2-4]
- ☑ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: 40 %GLIDE: 40 %RUN: 5 %RIFFLE: 15

Gradient: 10 — Maximum 10

EPA 4520 06/16/06

* - ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS.

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PC SD 60 | **DATE:** 2012-03-28 (YYYY-MM-DD)

Transect	Feature Type	Grabs 1	2	3	4	5	6	7	8	9	10
1	RF	8	21	27	25	19	14	C	29	C	SC
2	G	23	19	13	11	15	19	16	35	14	12
3	G	SC	VC	11	21	13	20	34	26	55	29
4	P	VC	13	17	20	MC	VC	26	16	11	15
5	P	VC	VC	LC	16	MC	VC	17	C	M	VF
6	P	1100	1200	3	22	2000	8	32	VC	VC	VC
7	RN	410	7	6	60	45	VC	6	32	43	17
8	RF	BM	BM	110	120	18	4	11	55	18	6
9	P	HP	HP	HP	HP	HP	18	28	VC	3	11
10	RF	21	50	37	17	42	17	110	48	27	MC

BM = Boulder Md.

MC = Med Cobble

LC = Large Cobble

Abbreviations:

Silt/Clay	= SC	Sand – Coarse	= C
Sand – Very Fine	= VF	Sand – Very	= VC
Sand – Fine	= F	Small Boulder	= SB
Sand – Medium	= M	Medium	= MB
Hardpan Clay –	= HP	Large Boulder	= LB
Bedrock – BR	= BR		

Feature Types:

Riffle	= RF
Run	= RN
Glide	= G
Pool	= P

After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

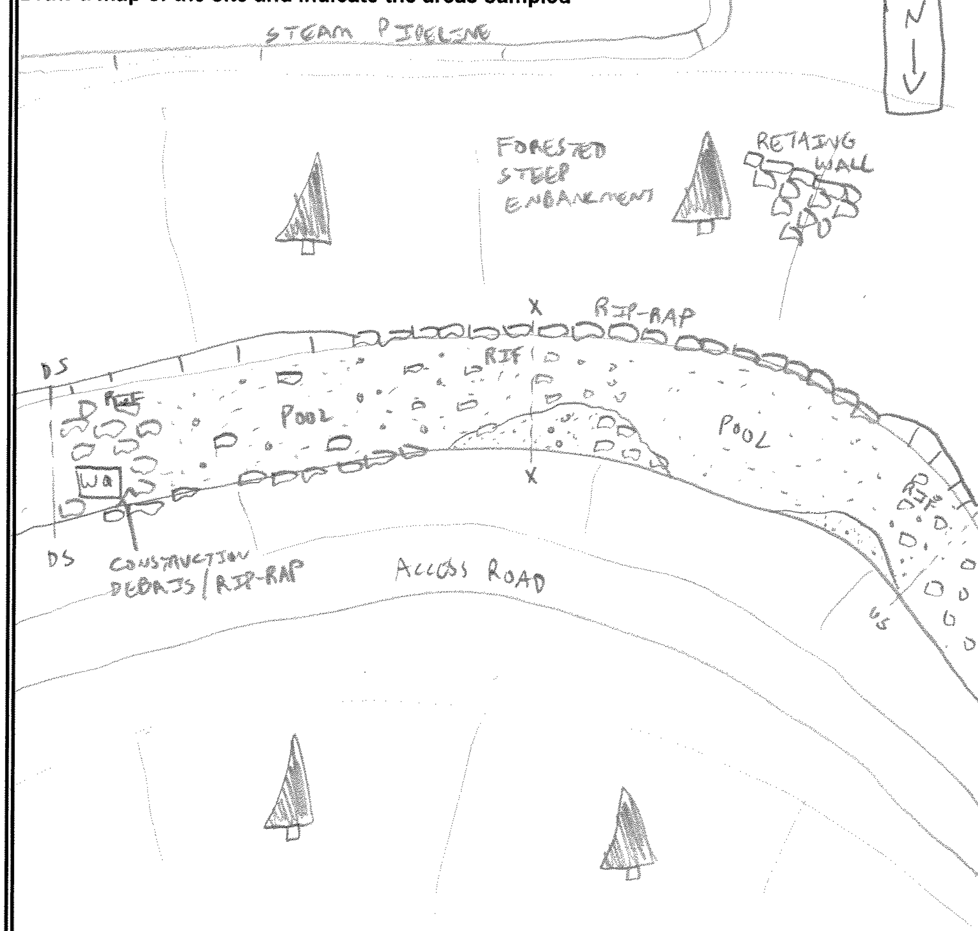
cB

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17PCSD61	Latitude 42.30980, 08	
PHOTO #	Longitude 087.84058	
INVESTIGATORS CB, BR, KS		
FORM COMPLETED BY CB	DATE 03-28-2012	REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ / ☐ storm (heavy rain) ☐ / ☐ rain (steady rain) ☐ / ☐ showers (intermittent) ☐ ____% / ☑ 20 %cloud cover ☑ / ☐ clear/sunny	**Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 57 °C F **Other** ________

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded **High Water Mark** 1.7 m **Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 2.8 m **Estimated Stream Depth** ☑ Riffle 0.10 m ☑ Run 0.25 m ☑ Pool 0.90 m **Velocity** 1m=5s ~~m/sec~~ **Estimated Reach Length** 300 FT ~~m~~ **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 60 %
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 11.02 °C **Specific Conductance** 1.72 ms/cm **Dissolved Oxygen** 9.16 mg/L **pH** 6.91 **Turbidity** 11.8 **WQ Instrument Used** HORIBA **Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☑ None ☐ Other **Turbidity (if not measured)** ☐ Clear ☑ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD61	
Reference or test? TEST		
FORM COMPLETED BY CB	DATE 03-28-2012 TIME 0830	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 40 % ☑ Snags 15 % ☐ Vegetated Banks ____ % ☑ Sand ~~15~~ 20 % ☐ Submerged Macrophytes ____ % ☐ Other (ROOTWADS) 25 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH < 10 FT → 10 BANK, 10 BOTTOM. BOTTOM: COARSE - ~~IIII~~ IIII; SOFT - IIII; DETRITUS - BANK: SNAG - III; ROOTWAD - ~~IIII~~ I LARGE PORTION OF RIGHT BANK IS RIP-RAP, REACH ALTERNATES BETWEEN SHALLOW AND DEEP AREAS DUE TO MODIFICATION.

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — QHEI Score: 61

Stream & Location: PETTIBONE CREEK — RM: ___ Date: 03/28/06

NTC17PCSD61 — Scorers Full Name & Affiliation: ___

River Code: ___ STORET #: ___ Lat./Long.: ___ /8 ___ Office verified location ☑

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

BEST TYPES (POOL / RIFFLE): ☐☐ BLDR/SLABS [10]; ☐☐ BOULDER [9]; ☐☑ COBBLE [8]; ☐☐ GRAVEL [7]; ☑☐ SAND [6]; ☐☐ BEDROCK [5]

OTHER TYPES (POOL / RIFFLE): ☐☐ HARDPAN [4]; ☐☐ DETRITUS [3]; ☐☐ MUCK [2]; ☐☐ SILT [2]; ☐☐ ARTIFICIAL [0] (Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2]; ☑ 3 or less [0]

ORIGIN *: ☐ LIMESTONE [1]; ☑ TILLS [1]; ☐ WETLANDS [0]; ☐ HARDPAN [0]; ☐ SANDSTONE [0]; ☑ RIP/RAP [0]; ☐ LACUSTURINE [0]; ☐ SHALE [-1]; ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2]; ☐ MODERATE [-1]; ☐ NORMAL [0]; ☑ FREE [1]. EMBEDDEDNESS: ☐ EXTENSIVE [-2]; ☑ MODERATE [-1]; ☐ NORMAL [0]; ☐ NONE [1]

Substrate: 14.5 (Maximum 20)

Comments

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]; 0 OVERHANGING VEGETATION [1]; 1 SHALLOWS (IN SLOW WATER) [1]; 0 ROOTMATS [1]

2 POOLS > 70cm [2]; 1 ROOTWADS [1]; 1 BOULDERS [1]

0 OXBOWS, BACKWATERS [1]; 0 AQUATIC MACROPHYTES [1]; 1 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11]; ☐ MODERATE 25-75% [7]; ☑ SPARSE 5-<25% [3]; ☐ NEARLY ABSENT <5% [1]

Comments — Cover: 10 (Maximum 20)

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4]; ☐ MODERATE [3]; ☑ LOW [2]; ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7]; ☐ GOOD [5]; ☑ FAIR [3]; ☐ POOR [1]

CHANNELIZATION: ☐ NONE [6]; ☐ RECOVERED [4]; ☐ RECOVERING [3]; ☑ RECENT OR NO RECOVERY [1]

STABILITY: ☐ HIGH [3]; ☑ MODERATE [2]; ☐ LOW [1]

Comments — Channel: 8 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average). River right looking downstream.

EROSION (L R): ☑☐ NONE / LITTLE [3]; ☐☑ MODERATE [2]; ☐☐ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4]; ☐☑ MODERATE 10-50m [3]; ☐☐ NARROW 5-10m [2]; ☑☐ VERY NARROW < 5m [1]; ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3]; ☐☐ SHRUB OR OLD FIELD [2]; ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]; ☐☐ FENCED PASTURE [1]; ☐☐ OPEN PASTURE, ROWCROP [0]; ☐☐ CONSERVATION TILLAGE [1]; ☑☑ URBAN OR INDUSTRIAL [0]; ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments — Riparian: 4.5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!): ☑ > 1m [6]; ☐ 0.7-<1m [4]; ☐ 0.4-<0.7m [2]; ☐ 0.2-<0.4m [1]; ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average): ☑ POOL WIDTH > RIFFLE WIDTH [2]; ☐ POOL WIDTH = RIFFLE WIDTH [1]; ☐ POOL WIDTH > RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply: ☐ TORRENTIAL [-1]; ☐ VERY FAST [1]; ☑ FAST [1]; ☑ MODERATE [1]; ☑ SLOW [1]; ☐ INTERSTITIAL [-1]; ☐ INTERMITTENT [-2]; ☐ EDDIES [1]. Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments — Pool / Current: 11 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2]; ☐ BEST AREAS 5-10cm [1]; ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2]; ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☑ STABLE (e.g., Cobble, Boulder) [2]; ☐ MOD. STABLE (e.g., Large Gravel) [1]; ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2]; ☐ LOW [1]; ☑ MODERATE [0]; ☐ EXTENSIVE [-1]

Comments — Riffle / Run: 3 (Maximum 8)

6] GRADIENT (10 ft/mi) ☐ VERY LOW - LOW [2-4]; ☑ MODERATE [6-10]; ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 50 %GLIDE: 30 %RUN: 5 %RIFFLE: 15

Gradient: 10 (Maximum 10)

EPA 4520 — 06/16/06

* ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS.

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD61

DATE: 2012-03-28 (YYYY-MM-DD)

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	RN	VC	8	6	151	24	HP	HP	HP	HP	HP
2	G	24	110	130	C	17	VC	VC	70	45	23
3	G	VF	M	11	13	33	17	14	19	MB	C
4	P	SB	9	SB	110	VC	110	SB	MB	83	14
5	RN	C	22	37	42	70	14	110	6	C	49
6	RN	5	37	14	18	18	42	112	32	123	54
7	G	68	28	32	27	60	27	35	30	33	24
8	P	F	VF	VF	HP	HP	HP	25	HP	HP	HP
9	G	C	90	15	42	22	72	3	4	105	115
10	RF	200	160	32	172	48	58	55	32	43	55

Abbreviations:

Silt/Clay = SC
Sand – Very Fine = VF
Sand – Fine = F
Sand – Medium = M
Hardpan Clay – = HP
Bedrock – BR = BR
Sand – Coarse = C
Sand – Very = VC
Small Boulder = SB
Medium = MB
Large Boulder = LB

Feature Types:

Riffle = RF
Run = RN
Glide = G
Pool = P

After recording transects above transcribe data into table below. Usually done by data entry person.

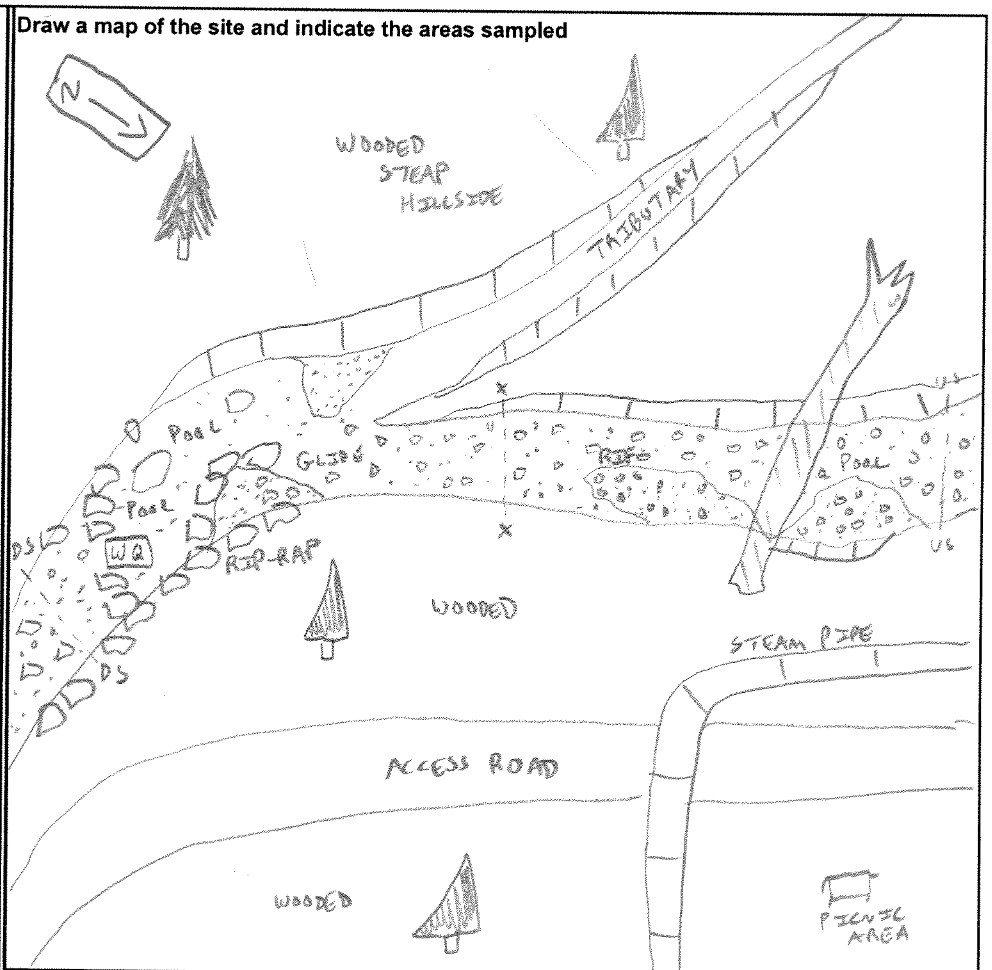
Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES
STATION # NTC17PCSD62	Latitude 42.30929
PHOTO #	Longitude 087.83430
INVESTIGATORS CB, BR.	
FORM COMPLETED BY CB	DATE 03-27-2012 / REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION

Subsystem Classification
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

WEATHER CONDITIONS

Now	Past 24 hours	
☐	☐	storm (heavy rain)
☐	☐	rain (steady rain)
☐	☐	showers (intermittent)
☑ 15 %	☑ 100	%cloud cover
☐	☐	clear/sunny

Has there been a heavy rain in the last 7 days?
☑ Yes ☐ No

Air Temperature 68 ° ~~C~~ F

Other__________

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded **High Water Mark** 2.0 m	**Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 3.3 m **Estimated Stream Depth** ☑ Riffle 0.10 m ☑ Run 0.20 m ☑ Pool 0.55 m **Velocity** [illegible] ~~m/sec~~ **Estimated Reach Length** 300 ~~m~~ FT **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 15 %	
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other_____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other_____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 12.34 °C **Specific Conductance** 1.64 ms/cm **Dissolved Oxygen** 10.78 mg/L **pH** 8.33 **Turbidity** 13.2 **WQ Instrument Used** HORIBA	**Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other_____ **Water Surface Oils** ☐ Slick ☑ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other_____ **Turbidity (if not measured)** ☐ Clear ☑ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other_____

cb

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD62	
Reference or test? TEST		
FORM COMPLETED BY CB	DATE 03-27-2012 TIME 1630	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 35 % ☑ Snags 25 % DETRITUS - 5% ☐ Vegetated Banks ____ % ☑ Sand 25 % ☐ Submerged Macrophytes ____ % ☑ Other (ROOTWADS) 10 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH < 10 FT. → 10 BANK / 10 BOTTOM BOTTOM - COARSE - ~~IIII~~ II; FINE - ~~IIII~~; DETRITUS - I BANK - SNAGS - ~~IIII~~; ROOTWADS - II HEAVILY ERODED, INCISED STREAM. SOME RIP-RAP PRESENT ON BANKS AND IN STREAM MAY BE CONSTRUCTION DEBRIS.

Ohio EPA — Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — **QHEI Score: 56.5**

Stream & Location: PETTIBONE CREEK **RM:** ___ **Date:** 03/27/06

NTC17PCSD62 **Scorers Full Name & Affiliation:** C. BARBOUR TE

River Code: __ - __ - __ **STORET #:** ____ **Lat./Long.:** ____ /8____ Office verified location ☑

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

P	R	BEST TYPES	POOL	RIFFLE	P	R	OTHER TYPES	POOL	RIFFLE
☐	☐	BLDR /SLABS [10]			☐	☐	HARDPAN [4]		
☐	☐	BOULDER [9]			☐	☐	DETRITUS [3]		
☐	☐	COBBLE [8]			☐	☐	MUCK [2]		
☐	☑	GRAVEL [7]			☐	☐	SILT [2]		
☑	☐	SAND [6]			☐	☐	ARTIFICIAL [0]		
☐	☐	BEDROCK [5]					(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

ORIGIN *: ☐ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☑ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☐ NORMAL [0] ☑ FREE [1]; EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Comments

Substrate: 13.5 (Maximum 20)

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0	UNDERCUT BANKS [1]	1	POOLS > 70cm [2]	1	OXBOWS, BACKWATERS [1]
0	OVERHANGING VEGETATION [1]	1	ROOTWADS [1]	0	AQUATIC MACROPHYTES [1]
1	SHALLOWS (IN SLOW WATER) [1]	2	BOULDERS [1]	1	LOGS OR WOODY DEBRIS [1]
0	ROOTMATS [1]				

AMOUNT Check ONE (Or 2 & average): ☐ EXTENSIVE >75% [11] ☐ MODERATE 25-75% [7] ☑ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 10 (Maximum 20)

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☑ LOW [1]
☐ NONE [1]	☑ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel: 5 (Maximum 20)

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average). River right looking downstream

L	R	EROSION	L	R	RIPARIAN WIDTH	L	R	FLOOD PLAIN QUALITY	L	R	
☐	☐	NONE / LITTLE [3]	☐	☐	WIDE > 50m [4]	☐	☐	FOREST, SWAMP [3]	☐	☐	CONSERVATION TILLAGE [1]
☑	☐	MODERATE [2]	☐	☑	MODERATE 10-50m [3]	☐	☐	SHRUB OR OLD FIELD [2]	☐	☐	URBAN OR INDUSTRIAL [0]
☐	☑	HEAVY / SEVERE [1]	☑	☐	NARROW 5-10m [2]	☑	☑	RESIDENTIAL, PARK, NEW FIELD [1]	☐	☐	MINING / CONSTRUCTION [0]
			☐	☐	VERY NARROW < 5m [1]	☐	☐	FENCED PASTURE [1]			
			☐	☐	NONE [0]	☐	☐	OPEN PASTURE, ROWCROP [0]			

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 5 (Maximum 10)

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply	
☑ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH > RIFFLE WIDTH [0]	☑ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 11 (Maximum 12)

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run: 2 (Maximum 8)

6] GRADIENT (10.0 ft/mi) ☐ VERY LOW - LOW [2-4] ☐ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]
DRAINAGE AREA (mi²)

%POOL: 10 %GLIDE: 60
%RUN: 10 %RIFFLE: 20

Gradient: 10 (Maximum 10)

EPA 4520 06/16/06

*-ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY / WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS.

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD 62 | **DATE:** 2012-03-27 (YYYY-MM-DD)

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	G	M	C	54	VC	MB	20	VC	VC	6	9
2	R	12	73	32	25	29	12	VC	9	F	F
3	RF	17	14	21	16	25	22	VC	VC	8	13
4	RF	SC	VC	34	10	34	26	47	50	33	26
5	RN	C	9	28	45	33	M	38	40	HP	HP
6	G	16	VF	VF	VF	56	3	18	5	3	SC
7	G	M	C	3	3	5	HP	HP	HP	HP	HP
8	RN	12	140	75	26	23	11	143	HP	HP	HP
9	RN	58	66	50	57	47	127	81	32	41	60
10	RF	48	24	57	6	32	24	48	50	63	C

Abbreviations:

Silt/Clay	= SC	Sand – Coarse	= C
Sand – Very Fine	= VF	Sand – Very	= VC
Sand – Fine	= F	Small Boulder	= SB
Sand – Medium	= M	Medium	= MB
Hardpan Clay –	= HP	Large Boulder	= LB
Bedrock – BR	= BR		

Feature Types:

Riffle	= RF
Run	= RN
Glide	= G
Pool	= P

After recording transects above transcribe data into table below. Usually done by data entry person.

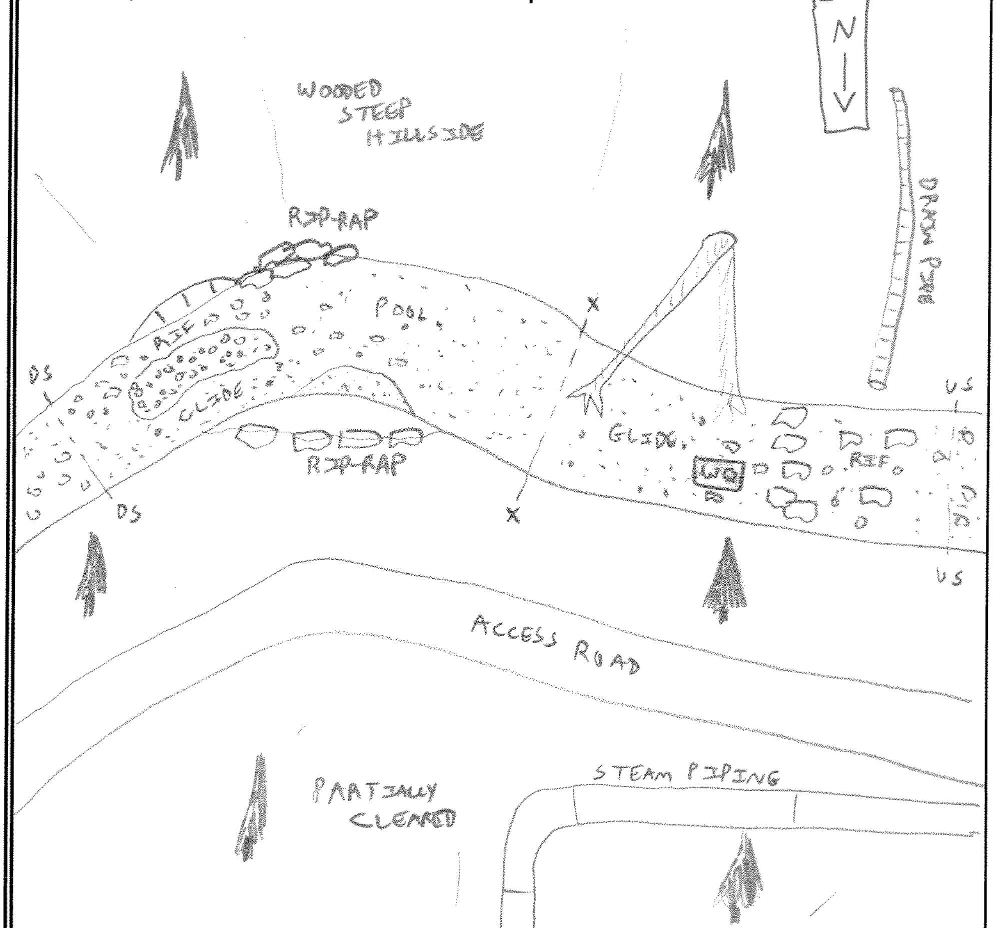
Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME: PETTIBONE CREEK	LOCATION: NAVAL STATION GREAT LAKES	
STATION # NTC17PCSD63	Latitude 42.30910	
PHOTO #	Longitude 087.83807	
INVESTIGATORS CB.		
FORM COMPLETED BY CB	DATE 03/27/2012	REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ ☐ storm (heavy rain) ☐ ☐ rain (steady rain) ☐ ☐ showers (intermittent) ☑ 30 % ☑ 100 %cloud cover ☐ ☐ clear/sunny	**Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 61 °¢F **Other**_____

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☑ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☑ Obvious sources **Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded **High Water Mark** 1.5 m	**Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 3.5 m **Estimated Stream Depth** ☑ Riffle 0.20 m ☑ Run 0.25 m ☑ Pool 0.35 m **Velocity** 3 sec/METER ~~m/sec~~ **Estimated Reach Length** 300 ~~m~~ FT **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 40 %	
SEDIMENT/ SUBSTRATE	**Odors** ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☑ None ☐ Other ______ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 10.60 °C **Specific Conductance** 1.69 ms/cm **Dissolved Oxygen** 11.44 mg/L **pH** 8.09 **Turbidity** 7.2 **WQ Instrument Used** HORIBA	**Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☑ Sheen ☐ Globs ☑ Flecks ☐ None ☐ Other ______ **Turbidity (if not measured)** ☐ Clear ☑ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other ______

CB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD63
Reference or test? TEST	

FORM COMPLETED BY	DATE / TIME	REASON FOR SURVEY
CD	DATE 03-27-2012 TIME 1300	

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 30 % ☐ Snags 10 % ☑ Vegetated Banks 25 % ☐ Sand 35 % ☐ Submerged Macrophytes ____ % ☐ Other ( ) ____ %
SAMPLE COLLECTION	**How were the samples collected?** ☑ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	MEAN WIDTH 15-29 FT -> 8 ~~BOTTOM~~ BANK ~~12~~ 12 BOTTOM. ~~COARSE~~ BOTTOM (12) BANK (8) 卌 - ~~GRAVEL~~ COURSE 卌 - TREE ROOT II 卌 - SOFT II - SNAG ~~II - COBBLE~~ CB I 卌 - COURSE (GRAVEL, COBBLE) II 卌 - SOFT (SAND / SILT) HIGHLY MODIFIED, HEAVY EROSION OUTSIDE OF REACH. MUCH OF SUBSTRATE IS CONSTRUCTION DEBRIS.

OhioEPA **Qualitative Habitat Evaluation Index and Use Assessment Field Sheet** **QHEI Score:** 61

Stream & Location: PETTIBONE CREEK **RM:** ___ . ___ **Date:** 03/27/06

NTC17PCSD63 **Scorers Full Name & Affiliation:** ______

River Code: __ - __ - __ **STORET #:** ______ **Lat./Long.:** __ . ______ / 8 __ . ______ (NAD 83 - decimal °) Office verified location ☑

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

P	R	BEST TYPES	POOL	RIFFLE	P	R	OTHER TYPES	POOL	RIFFLE
☐	☐	BLDR /SLABS [10]			☐	☐	HARDPAN [4]		
☐	☐	BOULDER [9]		1	☐	☐	DETRITUS [3]		
☐	☑	COBBLE [8]		1	☐	☐	MUCK [2]		
☐	☐	GRAVEL [7]	1	1	☐	☐	SILT [2]		
☑	☐	SAND [6]	1		☐	☐	ARTIFICIAL [0]		
☐	☐	BEDROCK [5]					(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN *

☐ LIMESTONE [1]
☐ TILLS [1]
☐ WETLANDS [0]
☐ HARDPAN [0]
☐ SANDSTONE [0]
☑ RIP/RAP [0]
☐ LACUSTURINE [0]
☐ SHALE [-1]
☐ COAL FINES [-2]

QUALITY

SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate 13 Maximum 20

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
1 POOLS > 70cm [2]
2 ROOTWADS [1]
2 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
1 LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)

☐ EXTENSIVE >75% [11]
☑ MODERATE 25-75% [7]
☐ SPARSE 5-<25% [3]
☐ NEARLY ABSENT <5% [1]

Comments

Cover 14 Maximum 20

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☑ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel 9 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

L	R	EROSION	L	R	RIPARIAN WIDTH	L	R	FLOOD PLAIN QUALITY	L	R	
☐	☐	NONE / LITTLE [3]	☐	☐	WIDE > 50m [4]	☐	☐	FOREST, SWAMP [3]	☐	☐	CONSERVATION TILLAGE [1]
☑	☐	MODERATE [2]	☐	☑	MODERATE 10-50m [3]	☐	☐	SHRUB OR OLD FIELD [2]	☑	☑	URBAN OR INDUSTRIAL [0]
☐	☑	HEAVY / SEVERE [1]	☑	☐	NARROW 5-10m [2]	☐	☐	RESIDENTIAL, PARK, NEW FIELD [1]	☐	☐	MINING / CONSTRUCTION [0]
			☐	☐	VERY NARROW < 5m [1]	☐	☐	FENCED PASTURE [1]			Indicate predominant land use(s) past 100m riparian.
			☐	☐	NONE [0]	☐	☐	OPEN PASTURE, ROWCROP [0]			

Comments

Riparian 4 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)	CHANNEL WIDTH Check ONE (Or 2 & average)	CURRENT VELOCITY Check ALL that apply	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☑ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH > RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 8 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average) ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☑ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☐ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run 3 Maximum 8

6] GRADIENT (10.0 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 25 %GLIDE: 50 %RUN: 10 %RIFFLE: 15

Gradient 10 Maximum 10

EPA 4520 06/16/06

* - ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE.

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD 63 | **DATE:** 2012-03-27 (YYYY-MM-DD)

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	RIFFLE	C	25	27	30	10	24	HP	HP	SC	SC
2	~~RF~~ RUN/G	SC	50	10	12	10	15	23	26	SC	SC
3	G	M	C	24	19	13	30	50	CM	CS	16
4	P	M	C	VC	10	9	13	11	SC	18	35
5	P	15	20	18	120	17	C	16	VF	SC	SC
6	RN	8	45	130	23	30	47	52	34	24	50
7	G	SC	SC	M	VC	21	11	VC	VC	C	22
8	RN	HP	HP	6	5	28	31	VC	VC	32	23
9	RN	M	C	52	47	53	18	C	48	10	49
10	RF	47	21	C	16	LB	63	65	56	30	21

100
65
#8 = CM

Abbreviations:
Silt/Clay = SC
Sand – Very Fine = VF
Sand – Fine = F
Sand – Medium = M
Hardpan Clay – = HP
Bedrock – BR = BR
Sand – Coarse = C
Sand – Very = VC
Small Boulder = SB
Medium = MB
Large Boulder = LB

Feature Types:
Riffle = RF
Run = RN
Glide = G
Pool = P

After recording transects above transcribe data into table below. Usually done by data entry person.

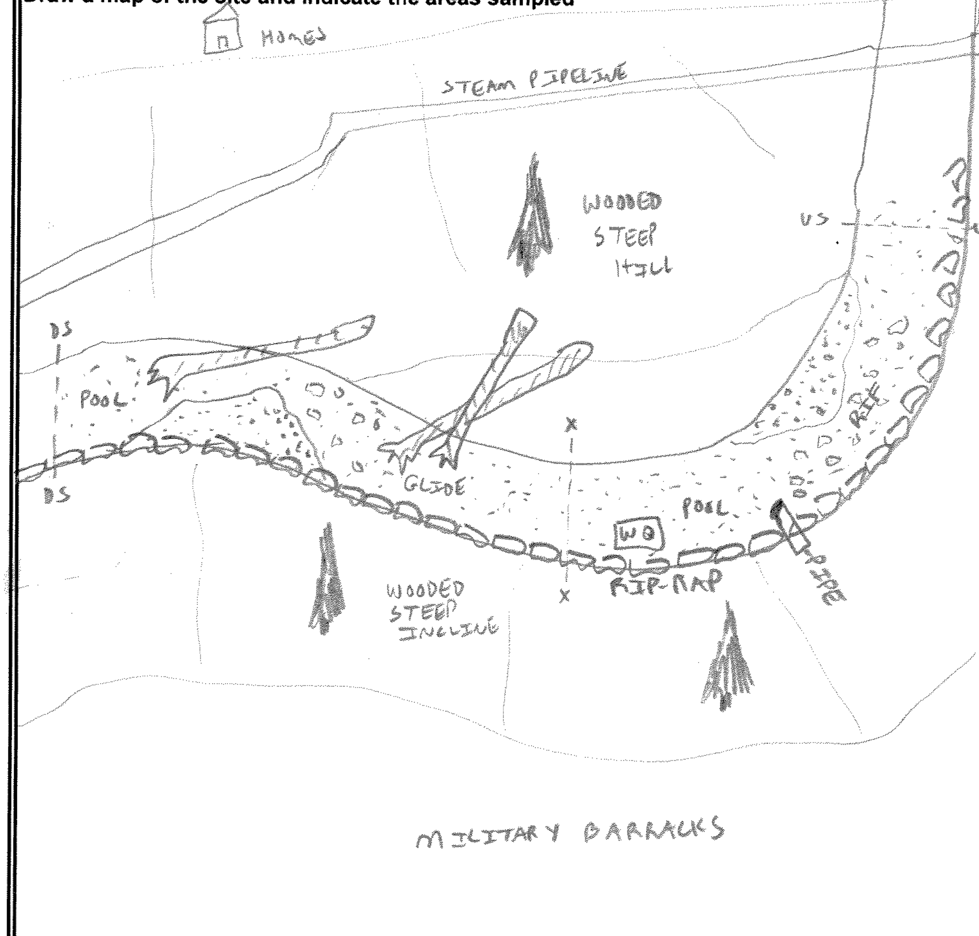
Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17PCSD64	Latitude 42.30472	
PHOTO #	Longitude 087.83699	
INVESTIGATORS CB, BR		
FORM COMPLETED BY CB	DATE 03/27/2012	REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION	**Subsystem Classification** ☐ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ / ☐ storm (heavy rain) ☐ / ☐ rain (steady rain) ☐ / ☐ showers (intermittent) ☑ 20 % / ☑ 100 %cloud cover ☐ / ☐ clear/sunny	**Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 65 ° ~~C~~ F **Other**

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

<table>
<tr><td>RIPARIAN ZONE/ INSTREAM FEATURES</td><td>Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☑ Other MILITARY BASE
☑ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Canopy Cover
☐ Partly open ☑ Partly shaded ☐ Shaded

High Water Mark 1.8 m</td><td>Local Water Erosion
☐ None ☐ Moderate ☑ Heavy

Estimated Stream Width 4.5 m

Estimated Stream Depth
☑ Riffle 0.20 m ☑ Run 0.50 m
☑ Pool 0.80 m

Velocity 1m=45 ~~m/sec~~

Estimated Reach Length 300 FT m

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No</td></tr>
<tr><td>RIPARIAN VEGETATION (18 meter buffer)</td><td colspan="2">Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present DECIDUOUS</td></tr>
<tr><td>AQUATIC VEGETATION</td><td colspan="2">Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating
☐ Free Floating
☐ Floating Algae ☑ Attached Algae

dominant species present UNKNOWN

Portion of the reach with vegetative cover 45 %</td></tr>
<tr><td>SEDIMENT/ SUBSTRATE</td><td>Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other ____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse</td><td>Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☐ Other ____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No</td></tr>
<tr><td>WATER QUALITY</td><td>Temperature 11.86 °C

Specific Conductance 1.66 ms/cm

Dissolved Oxygen 12.04 mg/L

pH 8.35

Turbidity 8.3

WQ Instrument Used HORIBA</td><td>Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ____
Water Surface Oils
☐ Slick ☑ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other ____
Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Water color ☐ Other ____</td></tr>
</table>

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME PETTIBONE CREEK	STATION # NTC17PCSD64	
Reference or test?		
FORM COMPLETED BY CB	DATE 03/27/2012 TIME 1510	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 20 % ☑ Snags 25 % DETRITUS - 20 ❑ Vegetated Banks ____ % ☑ Sand 25 % ❑ Submerged Macrophytes ____ % ☑ Other (ROOTWAD) ~~5~~ 10 % CB
SAMPLE COLLECTION	**How were the samples collected?** ☑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble ____ ❑ Snags ____ ❑ Vegetated Banks ____ ❑ Sand ____ ❑ Submerged Macrophytes ____ ❑ Other ( ) ____
GENERAL COMMENTS	BOTTOM (12) COARSE - IIII SOFT - ~~IIII~~ DETRITUS - IIII BANK (8) SNAG - ~~IIII~~ ROOTWAD - II BOTTOM OF REACH ~~X~~ WAS DISTURBED DUE TO FALLEN TREES AND MAINTENANCE CREW CLEANUP. ENTIRE LEFT BANK SHORED WITH RIP-RAP.

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

OhioEPA

QHEI Score: 56.5

Stream & Location: PETTIBONE CREEK **RM:** ___ **Date:** 03/27/06

NTC 17 PCSD 64 **Scorers Full Name & Affiliation:** CHAD BARBOUR TT

River Code: ___ **STORET #:** ___ **Lat./Long.:** ___ /8 ___ Office verified location ☑

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present. Check ONE (Or 2 & average)

P	R	BEST TYPES	POOL	RIFFLE			OTHER TYPES	POOL	RIFFLE
☐	☐	BLDR /SLABS [10]			☐	☐	HARDPAN [4]		
☐	☐	BOULDER [9]			☐	☐	DETRITUS [3]	|	
☐	☐	COBBLE [8]		|	☐	☐	MUCK [2]	|	
☐	☑	GRAVEL [7]		|	☐	☐	SILT [2]		
☑	☐	SAND [6]	|	|	☐	☐	ARTIFICIAL [0]		
☐	☐	BEDROCK [5]					(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

ORIGIN * (Check ONE (Or 2 & average))
- ☐ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☑ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☑ NORMAL [0]
- ☐ NONE [1]

Comments

Substrate 13.5 Maximum 20

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0	UNDERCUT BANKS [1]	1	POOLS > 70cm [2]	0	OXBOWS, BACKWATERS [1]
0	OVERHANGING VEGETATION [1]	1	ROOTWADS [1]	0	AQUATIC MACROPHYTES [1]
1	SHALLOWS (IN SLOW WATER) [1]	1	BOULDERS [1]	1	LOGS OR WOODY DEBRIS [1]
0	ROOTMATS [1]				

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☑ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover 9 Maximum 20

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☑ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel 8 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

L	R	EROSION	L	R	RIPARIAN WIDTH	L	R	FLOOD PLAIN QUALITY	L	R	
☑	☐	NONE / LITTLE [3]	☐	☐	WIDE > 50m [4]	☐	☐	FOREST, SWAMP [3]	☐	☐	CONSERVATION TILLAGE [1]
☐	☐	MODERATE [2]	☐	☑	MODERATE 10-50m [3]	☐	☐	SHRUB OR OLD FIELD [2]	☐	☐	URBAN OR INDUSTRIAL [0]
☐	☑	HEAVY / SEVERE [1]	☐	☐	NARROW 5-10m [2]	☑	☑	RESIDENTIAL, PARK, NEW FIELD [1]	☐	☐	MINING / CONSTRUCTION [0]
			☑	☐	VERY NARROW < 5m [1]	☐	☐	FENCED PASTURE [1]			
			☐	☐	NONE [0]	☐	☐	OPEN PASTURE, ROWCROP [0]			

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian 5 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☑ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☑ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential
Primary Contact
Secondary Contact
(circle one and comment on back)

Comments

Pool / Current 9 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5-10cm [1]
- ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☑ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☑ MODERATE [0]
- ☐ EXTENSIVE [-1]

Comments

Riffle / Run 2 Maximum 8

6] GRADIENT (10.0 ft/mi)
DRAINAGE AREA (mi²)

- ☐ VERY LOW - LOW [2-4]
- ☑ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: 25 %GLIDE: 50
%RUN: 5 %RIFFLE: 20

Gradient 10 Maximum 10

EPA 4520 06/16/06

* - ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS.

Reviewed By: GB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD 64 | **DATE:** 2012-03-27 (YYYY-MM-DD)

Transect	Feature Type	Grabs 1	2	3	4	5	6	7	8	9	10
1	RF	19	33	26	9	20	50	32	7	40	13
2	RN	M	M	C	23	65	~~>200~~ [illegible]	~~>200~~ [illegible]	~~>200~~ [illegible]	C	14
3	P	M	VC	16	15	12	120	~~>1000~~ LB	~~>1000~~ LB	21	M
4	G	VC	VC	VC	19	8	~~>1000~~ [illegible]	~~>1000~~ [illegible]	~~>1000~~ [illegible]	SC	SC
5	RF	M	9	14	VC	VC	8	4	7	5	4
6	RN	SC	SC	C	27	M	16	VF	VF	VF	SC
7	G	18	22	42	24	7	28	127	163	56	98
8	G	13	43	14	28	123	49	48	24	21	37
9	RN	17	40	23	19	17	41	42	29	44	32
10	RN	36	68	HP	HP	HP	HP	40	8	VC	M

Abbreviations:

Silt/Clay	= SC	Sand – Coarse	= C
Sand – Very Fine	= VF	Sand – Very	= VC
Sand – Fine	= F	Small Boulder	= SB
Sand – Medium	= M	Medium	= MB
Hardpan Clay –	= HP	Large Boulder	= LB
Bedrock – BR	= BR		

Feature Types:

Riffle	= RF
Run	= RN
Glide	= G
Pool	= P

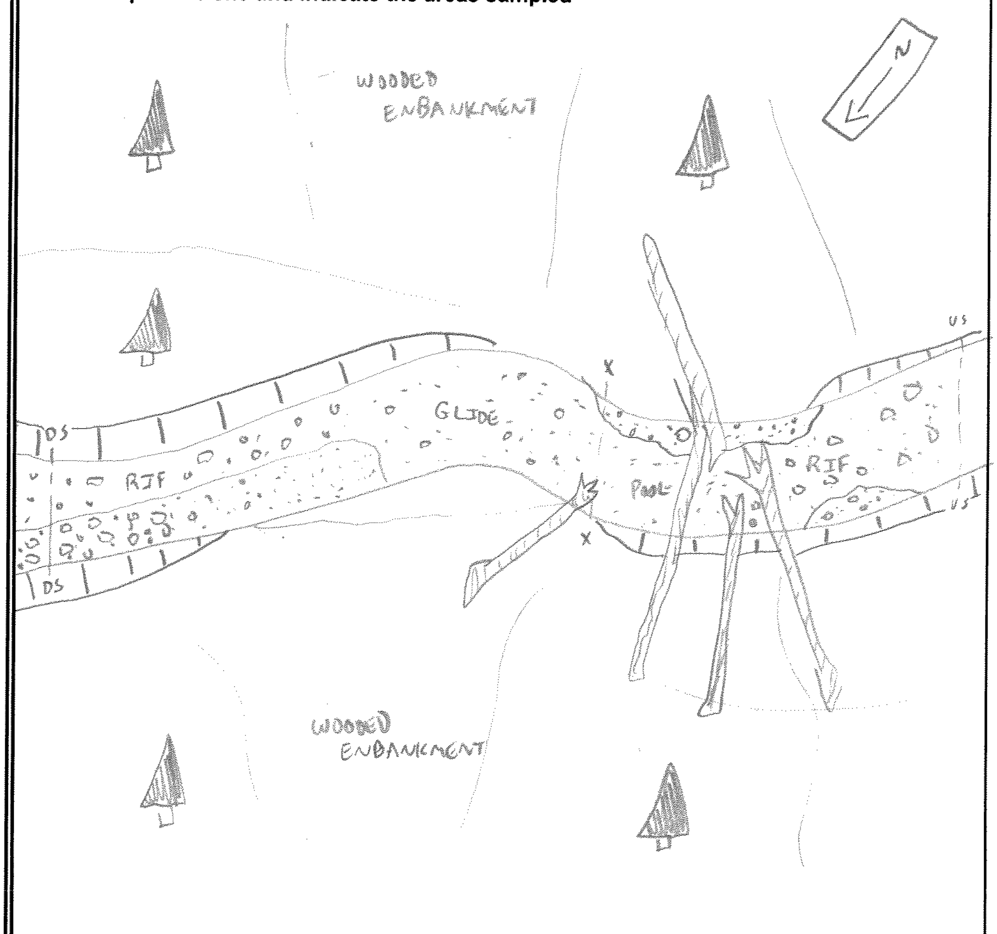
After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

CB

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME SOUTH BRANCH PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17 PCSD 65	Latitude 42.30893	
PHOTO #	Longitude 087.84095	
INVESTIGATORS CB, BR, KS		
FORM COMPLETED BY CB	DATE 03-29-2012	REASON FOR SURVEY

SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled** 
STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal **Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ / ☐ storm (heavy rain) ☐ / ☐ rain (steady rain) ☐ / ☐ showers (intermittent) ☐ ____% / ☐ ____%cloud cover ☑ / ☑ clear/sunny **Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 49 °~~C~~F **Other**____________

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

<table>
<tr><td>RIPARIAN ZONE/ INSTREAM FEATURES</td><td>Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☑ Other MILITARY BASE
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Canopy Cover
☐ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark 1.5* m
* DIFFICULT TO DETERMINE DUE TO EROSION.</td><td>Local Water Erosion
☐ None ☐ Moderate ☑ Heavy

Estimated Stream Width 2.0 m

Estimated Stream Depth
☑ Riffle 0.10 m ☑ Run 0.25 m
☑ Pool 0.60 m

Velocity 1m=.035 m/sec

Estimated Reach Length 300 m FT

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No</td></tr>
<tr><td>RIPARIAN VEGETATION (18 meter buffer)</td><td colspan="2">Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present DECIDUOUS</td></tr>
<tr><td>AQUATIC VEGETATION</td><td colspan="2">Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating
☐ Floating Algae ☑ Attached Algae

dominant species present UNKNOWN

Portion of the reach with vegetative cover 65 %</td></tr>
<tr><td>SEDIMENT/ SUBSTRATE</td><td>Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse</td><td>Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☐ Other

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No</td></tr>
<tr><td>WATER QUALITY</td><td>Temperature 8.77 °C

Specific Conductance 1.73 mS/cm

Dissolved Oxygen 14.28 mg/L

pH 8.05

Turbidity 17.1* – TURBIDITY HIGH FROM WALKING IN CHANNEL

WQ Instrument Used HOR-IBA</td><td>Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other
Water Surface Oils
☐ Slick ☑ Sheen ☐ Globs ☑ Flecks
☐ None ☐ Other
Turbidity (if not measured)
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Water color ☐ Other</td></tr>
</table>

CB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME SOUTH BRANCH PETTIBONE CR.	STATION # NTC17PCSD65
Reference or test? REFERENCE	

FORM COMPLETED BY	DATE / TIME	REASON FOR SURVEY
CB	DATE 03-29-2012 TIME 1009	

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 40 % ☑ Snags 30 % ❑ Vegetated Banks ____ % ☑ Sand 20 % ❑ Submerged Macrophytes ____ % ☑ Other (ROOTWAD) 10 %
SAMPLE COLLECTION	**How were the samples collected?** ❑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble ____ ❑ Snags ____ ❑ Vegetated Banks ____ ❑ Sand ____ ❑ Submerged Macrophytes ____ ❑ Other ( ) ____
GENERAL COMMENTS	WIDTH < 10 FT. —> 10 BOTTOM, 10 BANK. BOTTOM: COARSE - 𝍸 III; FINE - IIII; DETRITUS - BANK: SNAG - 𝍸 I; ROOTWAD - II HEAVILY ERODED BANKS WITH MANY TREES FALLING INTO CHANNEL. PORTIONS OF REACH SCOURED TO SILT-CLAY LAYER.

Ohio EPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 62.5

Stream & Location: SOUTH BRANCH PETTIBONE CREEK **RM:** ___.__ **Date:** 03/29/08 2012

NTC17 PCSD65 **Scorers Full Name & Affiliation:**

River Code: __ - ___ - ___ **STORET #:** **Lat./ Long.:** (NAD 83 - decimal °) __.______ /8_.______ Office verified location ☐

1] SUBSTRATE

Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		1
☐☐ BOULDER [9]			☐☐ DETRITUS [3]	1	
☐☐ COBBLE [8]	1	1	☐☐ MUCK [2]		
☐☑ GRAVEL [7]	1	1	☐☐ SILT [2]	1	
☑☐ SAND [6]	1	1	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

Check ONE (Or 2 & average)

ORIGIN *
- ☐ LIMESTONE [1]
- ☑ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTURINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY
- SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]
- EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ NONE [1]

Substrate 14 Maximum 20

2] INSTREAM COVER

Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

- 1 UNDERCUT BANKS [1]
- 1 OVERHANGING VEGETATION [1]
- 1 SHALLOWS (IN SLOW WATER) [1]
- 0 ROOTMATS [1]
- 1 POOLS > 70cm [2]
- 1 ROOTWADS [1]
- 1 BOULDERS [1]
- 1 OXBOWS, BACKWATERS [1]
- 0 AQUATIC MACROPHYTES [1]
- 3 LOGS OR WOODY DEBRIS [1]

AMOUNT — Check ONE (Or 2 & average)
- ☐ EXTENSIVE >75% [11]
- ☐ MODERATE 25-75% [7]
- ☑ SPARSE 5-<25% [3]
- ☐ NEARLY ABSENT <5% [1]

Comments

Cover 12 Maximum 20

3] CHANNEL MORPHOLOGY

Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☑ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☑ LOW [2]	☐ FAIR [3]	☐ RECOVERING [3]	☑ LOW [1]
☐ NONE [1]	☑ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 10 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE

Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☑ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☐☐ MODERATE [2]	☑☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☑☑ URBAN OR INDUSTRIAL [0]
☑☑ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☐☐ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian 4.5 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH — Check ONE (ONLY!)
- ☑ > 1m [6]
- ☐ 0.7-<1m [4]
- ☐ 0.4-<0.7m [2]
- ☐ 0.2-<0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH — Check ONE (Or 2 & average)
- ☑ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH > RIFFLE WIDTH [0]

CURRENT VELOCITY — Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☑ MODERATE [1]
- ☑ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current 10 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments SCOURED TO SILT CLAY

Riffle / Run 2 Maximum 8

6] GRADIENT (10.0 ft/mi)

DRAINAGE AREA (mi²)

- ☐ VERY LOW - LOW [2-4]
- ☑ MODERATE [6-10]
- ☐ HIGH - VERY HIGH [10-6]

%POOL: 25 %GLIDE: 50

%RUN: 5 %RIFFLE: 20

Gradient 10 Maximum 10

EPA 4520 06/16/06

*-ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE.

Reviewed By: cB

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PC SD 65 | **DATE:** 2012-03-29 (YYYY-MM-DD)

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	RN	HP	HP	HP	11	16	HP	5	50	22	M
2	RF	19	HP	HP	65	HP	HP	HP	41	50	26
3	RN	20	100	110	70	80	21	CS*	65	55	49
4	RF	SC	35	47	58	50	42	35	43	65	45
5	RN	SC	SC	18	5	9	43	45	28	21	22
6	RF	HP	HP	VC	42	50	60	80	40	45	60
7	RF	120	80	60	HP	HP	C	40	100	50	SC
8	RF	43	50	18	30	32	40	40	25	25	20
9	G	VC	M	8	45	8	6	SC	SC	22	SC
10	P	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC

* COBBLE SMALL

Abbreviations:

Silt/Clay = SC
Sand – Very Fine = VF
Sand – Fine = F
Sand – Medium = M
Hardpan Clay – = HP
Bedrock – BR = BR
Sand – Coarse = C
Sand – Very = VC
Small Boulder = SB
Medium = MB
Large Boulder = LB

Feature Types:

Riffle = RF
Run = RN
Glide = G
Pool = P

After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

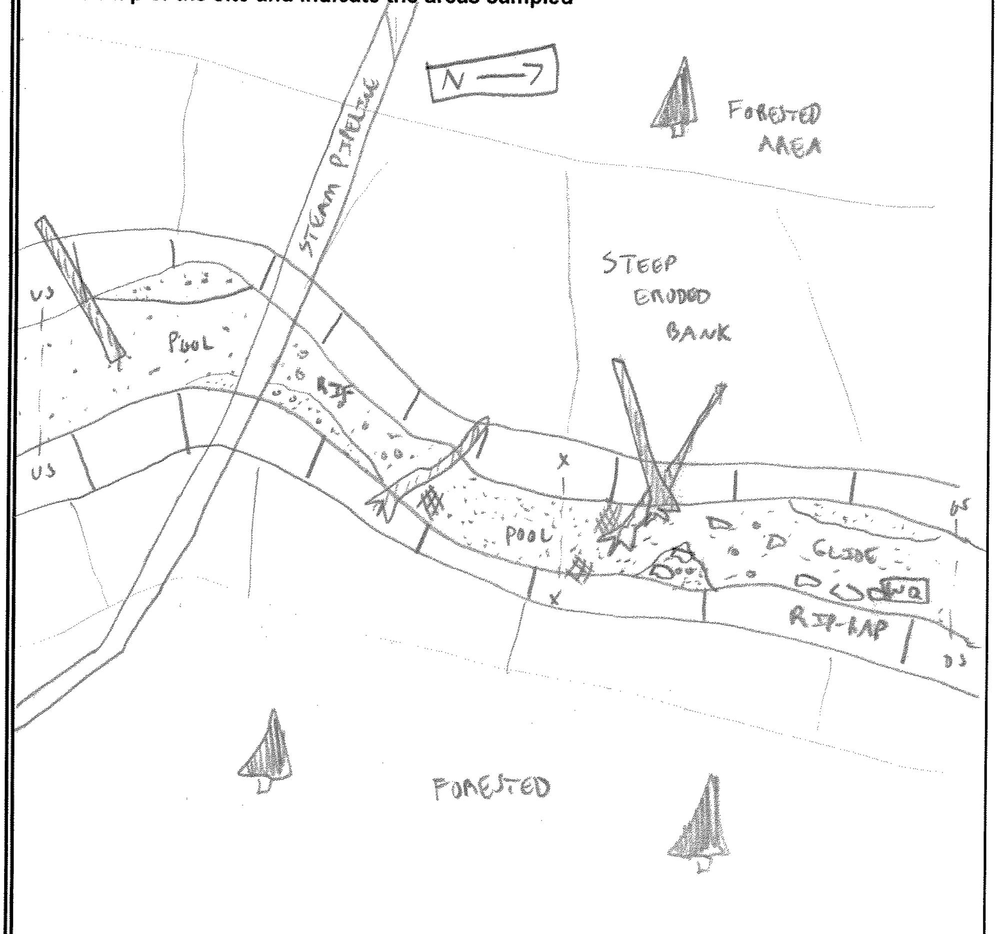
cB

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME: SOUTH BRANCH PETTIBONE CREEK	LOCATION: NAVAL STATION GREAT LAKES	
STATION # NTC17PLSD66	Latitude 42.30800	
PHOTO #	Longitude 087.84142	
INVESTIGATORS CB, BR, KS		
FORM COMPLETED BY: CB	DATE: 03-29-2012	REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION

Subsystem Classification
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

WEATHER CONDITIONS

Now	Past 24 hours	
☐	☐	storm (heavy rain)
☐	☐	rain (steady rain)
☐	☐	showers (intermittent)
☐ ____%	☐ ____	%cloud cover
☑	☑	clear/sunny

Has there been a heavy rain in the last 7 days?
☑ Yes ☐ No

Air Temperature 49 °C F

Other ____________

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** 1.4* m *DIFFICULT TO DETERMINE DUE TO EROSION OF BANKS.	**Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 2.1 m **Estimated Stream Depth** ☑ Riffle 0.16 m ☑ Run 0.25 m ☑ Pool 0.40 m **Velocity** 1m=4s m/sec **Estimated Reach Length** 300 FT ~~m~~ **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 35 %	
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 10.23 °C **Specific Conductance** 1.65 mS/cm **Dissolved Oxygen** 14.99 mg/L **pH** 8.15 **Turbidity** 8.5 NTU - MAY BE ELEVATED DUE TO WALKING IN STREAM **WQ Instrument Used** HORIBA	**Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____ **Water Surface Oils** ☐ Slick ☑ Sheen ☐ Globs ☑ Flecks ☐ None ☐ Other____ **Turbidity (if not measured)** ☑ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other____

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME SOUTH BRANCH PETTIBONE CR.	STATION # NTC17PCS066	
Reference or test? REFERENCE		
FORM COMPLETED BY CB	DATE 03-29-2012 TIME 1130	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 20 % ☑ Snags 35 % ROOTWAD - 5 ☐ Vegetated Banks ___ % ☑ Sand 20 % ☐ Submerged Macrophytes ___ % ☐ Other (DETRITUS) 10 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ___ ☐ Snags ___ ☐ Vegetated Banks ___ ☐ Sand ___ ☐ Submerged Macrophytes ___ ☐ Other ( ) ___
GENERAL COMMENTS	WIDTH <10 FT → 10 BOTTOM, 10 BANK. BOTTOM: COARSE - IIII; FINE - IIII; DETRITUS - II BANK: ROOTWAD - I; SNAG - ~~IIII~~ II HEAVILY ERODED BANKS, PORTIONS OF REACH SCOURED TO SILT/CLAY LAYER

cb

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — QHEI Score: 58.5

Stream & Location: SOUTH BRANCH PETTIBONE CREEK **RM:** ___ **Date:** 03/29/06 2012

NTC17PCSD66 **Scorers Full Name & Affiliation:**

River Code: - - **STORET #:** **Lat./Long.:** /8 . Office verified location ☑

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		1
☐☐ BOULDER [9]		1	☐☐ DETRITUS [3]		
☐☐ COBBLE [8]		1	☐☐ MUCK [2]	1	
☐☑ GRAVEL [7]	1	1	☐☐ SILT [2]	1	
☑☐ SAND [6]	1	1	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

ORIGIN* (Check ONE (Or 2 & average)): ☐ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY: SILT: ☐ HEAVY [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1]; EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate: 12 — Maximum 20

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]; 1 OVERHANGING VEGETATION [1]; 1 SHALLOWS (IN SLOW WATER) [1]; 0 ROOTMATS [1]; 1 POOLS > 70cm [2]; 1 ROOTWADS [1]; 1 BOULDERS [1]; 0 OXBOWS, BACKWATERS [1]; 0 AQUATIC MACROPHYTES [1]; 2 LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover: 14 — Maximum 20

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☑ LOW [2] ☐ NONE [1]

DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☑ FAIR [3] ☐ POOR [1]

CHANNELIZATION: ☐ NONE [6] ☐ RECOVERED [4] ☐ RECOVERING [3] ☑ RECENT OR NO RECOVERY [1]

STABILITY: ☐ HIGH [3] ☐ MODERATE [2] ☑ LOW [1]

Comments

Channel: 7 — Maximum 20

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average) — River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3] ☐☐ MODERATE [2] ☑☑ HEAVY / SEVERE [1]

RIPARIAN WIDTH (L R): ☐☑ WIDE > 50m [4] ☑☐ MODERATE 10-50m [3] ☐☐ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☐☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☑☑ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian: 4.5 — Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!)): ☐ > 1m [6] ☑ 0.7-<1m [4] ☐ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]

CHANNEL WIDTH (Check ONE (Or 2 & average)): ☑ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH > RIFFLE WIDTH [0]

CURRENT VELOCITY (Check ALL that apply): ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☑ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1] — Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current: 8 — Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☑ BEST AREAS < 5cm [metric=0]

RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☑ MAXIMUM < 50cm [1]

RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2] ☑ MOD. STABLE (e.g., Large Gravel) [1] ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☑ LOW [1] ☐ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run: 3 — Maximum 8

6] GRADIENT (10.0 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

DRAINAGE AREA (mi²)

%POOL: 20 %GLIDE: 60 %RUN: 5 %RIFFLE: 15

Gradient: 10 — Maximum 10

EPA 4520 06/16/06

* ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY, WAUKEGAN QUADRANGLE.

Reviewed By: cb

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD 66

DATE: 2012-03-29 (YYYY-MM-DD)

MC = Med. Cobble

		Grabs									
Transect	**Feature Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	RF	30	25	18	15	30	SC	40	35	12	30
2	G	C	8	40	50	80	45	25	35	35	12
3	RN	HP	18	23	20	5	28	22	4	30	13
4	RN	14	12	11	9	18	40	35	12	55	25
5	G	SC	C	C	10	6	7	MC	8	7	SC
6	P	HP	SC	HP	M	VF	SC	F	SC	SC	SC
7	RF	M	45	32	28	19	SC	40	45	38	22
8	G	SC	F	C	15	19	10	16	65	20	22
9	RF	VC	35	18	VC	30	21	12	8	11	C
10	RF	M	20	15	8	6	C	VC	8	4	10

Abbreviations:

Silt/Clay	= SC	Sand – Coarse	= C
Sand – Very Fine	= VF	Sand – Very	= VC
Sand – Fine	= F	Small Boulder	= SB
Sand – Medium	= M	Medium	= MB
Hardpan Clay –	= HP	Large Boulder	= LB
Bedrock – BR	= BR		

Feature Types:

Riffle	= RF
Run	= RN
Glide	= G
Pool	= P

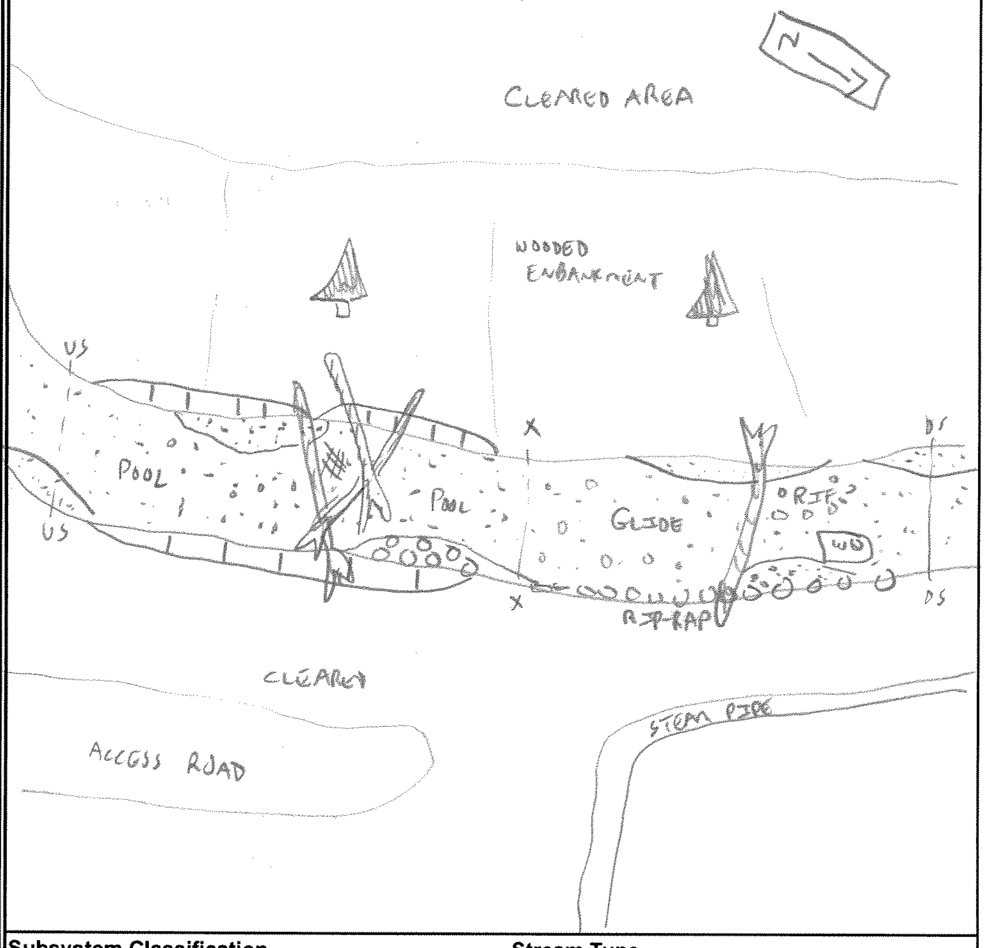
After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

CB

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME S. BRANCH PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17PCSD67	Latitude 42.30707	
PHOTO #	Longitude 087.84120	
INVESTIGATORS CB, BR, KS		
FORM COMPLETED BY CB	DATE 03-29-2012	REASON FOR SURVEY

SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled** 
STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal **Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ ☐ storm (heavy rain) ☐ ☐ rain (steady rain) ☐ ☐ showers (intermittent) ☑ 100 % ☑ 20 %cloud cover ☐ ☐ clear/sunny **Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 49 °C F **Other**__________

OB

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

<table>
<tr>
<td>RIPARIAN ZONE/ INSTREAM FEATURES</td>
<td>
Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☑ Other MILITARY BASE
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☑ Obvious sources

Canopy Cover
☐ Partly open ☑ Partly shaded ☐ Shaded

High Water Mark 1.2 m
</td>
<td>
Local Water Erosion
☐ None ☐ Moderate ☑ Heavy

Estimated Stream Width 2.1 m

Estimated Stream Depth
☑ Riffle 0.10 m ☑ Run 0.30 m
☑ Pool 0.70 m

Velocity 1m:7s m/sec

Estimated Reach Length 300 FT. m

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No
</td>
</tr>
<tr>
<td>RIPARIAN VEGETATION (18 meter buffer)</td>
<td colspan="2">
Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present DECIDUOUS
</td>
</tr>
<tr>
<td>AQUATIC VEGETATION</td>
<td colspan="2">
Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating
☐ Floating Algae ☑ Attached Algae

dominant species present UNKNOWN

Portion of the reach with vegetative cover 20 %
</td>
</tr>
<tr>
<td>SEDIMENT/ SUBSTRATE</td>
<td>
Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other ____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse
</td>
<td>
Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☐ Other ____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No
</td>
</tr>
<tr>
<td>WATER QUALITY</td>
<td>
Temperature 12.95 °C

Specific Conductance 1.42 mS/cm

Dissolved Oxygen 15.15

pH 8.39

Turbidity 9.1 NTU

WQ Instrument Used HORIBA
</td>
<td>
Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ____
Water Surface Oils
☐ Slick ☑ Sheen ☐ Globs ☑ Flecks
☐ None ☐ Other ____
Turbidity (if not measured)
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Water color ☐ Other ____
</td>
</tr>
</table>

CB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME S. BRANCH PETTIBONE CREEK		STATION # NTC17PCSD67
Reference or test?		
FORM COMPLETED BY CB	DATE 03-29-2012 TIME 1510	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 20 % ☑ Snags 45 % ROOTWAD - 5 ☐ Vegetated Banks ____ % ☑ Sand 25 % ☐ Submerged Macrophytes ____ % ☐ Other (DETRITUS) 5 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH <10 FT. → 10 BOTTOM, 10 BANK. BOTTOM: COARSE - IIII FINE - IIIII DETRITUS - I BANK: SNAGS - ~~IIII~~ IIII ROOTWADS - I RIGHT BANK ~~BUFFER~~ RIPARIAN IS CLEARED AREA.

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — **QHEI Score: 55.5**

Stream & Location: S. BRANCH PETTIBONE CREEK **RM:** __._ **Date:** 03/29/2012

NTC17PCSD67 **Scorers Full Name & Affiliation:**

River Code: - - **STORET #:** **Lat./Long.:** /8 . **Office verified location** ☑

1] SUBSTRATE
Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]		1	☐☐ DETRITUS [3]		
☐☑ COBBLE [8]		1	☐☐ MUCK [2]		
☐☐ GRAVEL [7]	1	1	☐☐ SILT [2]	1	
☑☐ SAND [6]	1	1	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]					

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

ORIGIN * (Check ONE (Or 2 & average)): ☐ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☑ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☐ MODERATE [-1] ☑ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate Maximum 20: **13.5**

2] INSTREAM COVER
Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1	UNDERCUT BANKS [1]	0	POOLS > 70cm [2]	0	OXBOWS, BACKWATERS [1]
1	OVERHANGING VEGETATION [1]	1	ROOTWADS [1]	0	AQUATIC MACROPHYTES [1]
1	SHALLOWS (IN SLOW WATER) [1]	1	BOULDERS [1]	2	LOGS OR WOODY DEBRIS [1]
0	ROOTMATS [1]				

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover Maximum 20: **13**

3] CHANNEL MORPHOLOGY
Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☐ NONE [6]	☐ HIGH [3]
☐ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☐ MODERATE [2]
☐ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☑ LOW [1]
☑ NONE [1]	☐ POOR [1]	☑ RECENT OR NO RECOVERY [1]	

Comments

Channel Maximum 20: **6**

4] BANK EROSION AND RIPARIAN ZONE
Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☑☐ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☑ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Indicate predominant land use(s) past 100m riparian.

Comments

Riparian Maximum 10: **5**

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☐ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☑ 0.4-<0.7m [2]	☐ POOL WIDTH > RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]			

Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current Maximum 12: **6**

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☑ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]		☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run Maximum 8: **2**

6] GRADIENT
GRADIENT (10.0 ft/mi) DRAINAGE AREA (mi²)

☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]

%POOL: 25 %GLIDE: 40 %RUN: 10 %RIFFLE: 25

Gradient Maximum 10: **10**

EPA 4520 06/16/06

* - ORIGIN DETERMINED FROM ILLINOIS STATE GEOLOGICAL SURVEY WAUKEGAN QUADRANGLE AND SITE OBSERVATIONS.

Reviewed By: cB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD67

DATE: 2012-03-29 (YYYY-MM-DD)

Transect	Feature Type	Grabs 1	2	3	4	5	6	7	8	9	10
1	RF	SC	9	15	20	100	47	120	C	11	SC
2	RF	HP	43	32	36	55	16	26	33	12	44
3	RF	HP	10	24	20	17	21	F	13	C	SC
4	RN	HP	HP	13	29	32	27	C	4	13	41
5	P	HP	HP	HP	HP	10	29	SC	SC	SC	SC
6	RN	HP	4	M	M	40	F	F	90	14	SC
7	RF	SC	SC	4	C	28	23	55	C	50	15
8	G	SC	SC	F	M	M	M	MC	C	C	M
9	G	M	M	C	C	C	F	M	F	F	F
10	R	10	F	8	F	M	45	F	F	SC	SC

MC = Med Cobble

Abbreviations:

Silt/Clay	= SC	Sand – Coarse	= C
Sand – Very Fine	= VF	Sand – Very	= VC
Sand – Fine	= F	Small Boulder	= SB
Sand – Medium	= M	Medium	= MB
Hardpan Clay –	= HP	Large Boulder	= LB
Bedrock – BR	= BR		

Feature Types:

Riffle	= RF
Run	= RN
Glide	= G
Pool	- P

After recording transects above transcribe data into table below. Usually done by data entry person.

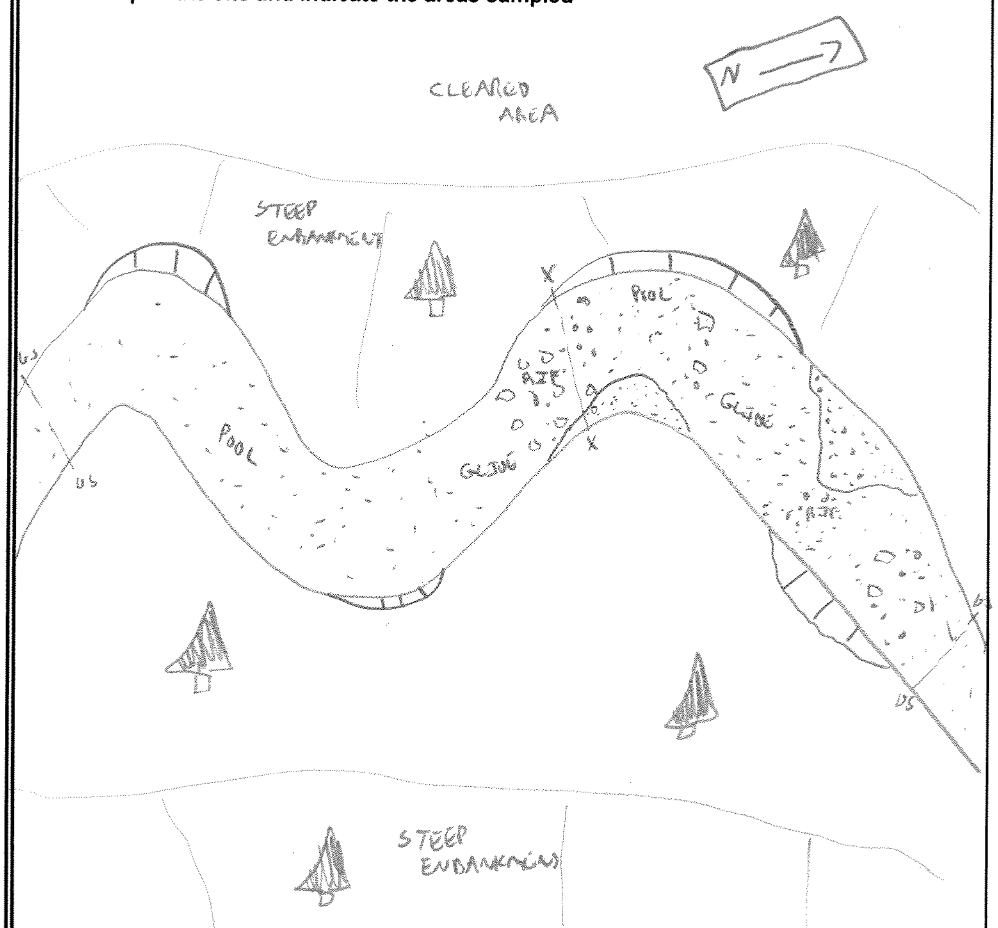
Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME SOUTH BRANCH PETTIBONE CREEK	LOCATION NAVAL STATION GREAT LAKES
STATION # NTC17PCSD68	Latitude 42.30549
PHOTO #	Longitude 087.84154
INVESTIGATORS CB, BR, KS	
FORM COMPLETED BY cB	DATE 3-29-2012
	REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION	**Subsystem Classification** ☑ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☐ Coldwater ☑ Warmwater
WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ ☐ storm (heavy rain) ☐ ☐ rain (steady rain) ☐ ☐ showers (intermittent) ☑ 10 % ☑ 20 %cloud cover ☐ ☐ clear/sunny	**Has there been a heavy rain in the last 7 days?** ☑ Yes ☐ No **Air Temperature** 52 °C F **Other**________

cB

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** 1.0 m	**Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 2.2 m **Estimated Stream Depth** ☑ Riffle 0.05 m ☐ Run ____ m ☑ Pool 0.65 m **Velocity** 1m=7s ~~m~~/sec **Estimated Reach Length** 300 FT ~~m~~ **Channelized** ☐ Yes ☑ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 50 %	
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other ____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 13.00 °C **Specific Conductance** 1.40 ms/cm **Dissolved Oxygen** 15.52 mg/L **pH** 8.40 **Turbidity** 4.1 NTU **WQ Instrument Used** HORIBA	**Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ____ **Water Surface Oils** ☐ Slick ☑ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other ____ **Turbidity (if not measured)** ☐ Clear ☑ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other ____

CB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME S. BR. PETTIBONE CREEK	STATION # NTC17 PCSD68
Reference or test?	

FORM COMPLETED BY	DATE	REASON FOR SURVEY
CB	03-29-2012 TIME 1615	

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 30 % ☑ Snags 30 % UNDERCUT-10 ☐ Vegetated Banks ____ % ☑ Sand 20 % ☐ Submerged Macrophytes ____ % ☐ Other (ROOTWAD) 10 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH <10 FT → 10 SUBSTRATE, 10 BANK. BOTTOM: COARSE - 卌 | FINE - |||| DETRITIS - BANK - SNAG - 卌 | ROOTWAD - || UNDERCUT - ||

OhioEPA

Qualitative Habitat Evaluation Index and Use Assessment Field Sheet

QHEI Score: 66

Stream & Location: SOUTH BRANCH PETTIBONE CREEK **RM:** ___ **Date:** 03/29/06 2012
NTC 17 PCSD 68 **Scorers Full Name & Affiliation:**
River Code: - - **STORET #:** **Lat./Long.:** . /8 . Office verified location ☑

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		
☐☐ BOULDER [9]			☐☐ DETRITUS [3]		
☐☐ COBBLE [8]			☐☐ MUCK [2]		
☐☑ GRAVEL [7]			☐☐ SILT [2]		
☑☐ SAND [6]			☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

Comments

ORIGIN * (Check ONE (Or 2 & average)): ☐ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1]

EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Substrate 12 Maximum 20

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

1 UNDERCUT BANKS [1] | 1 POOLS > 70cm [2] | 0 OXBOWS, BACKWATERS [1]
0 OVERHANGING VEGETATION [1] | 1 ROOTWADS [1] | 0 AQUATIC MACROPHYTES [1]
2 SHALLOWS (IN SLOW WATER) [1] | 1 BOULDERS [1] | 1 LOGS OR WOODY DEBRIS [1]
1 ROOTMATS [1]

Comments

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Cover 15 Maximum 20

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐ HIGH [4]	☐ EXCELLENT [7]	☑ NONE [6]	☐ HIGH [3]
☑ MODERATE [3]	☐ GOOD [5]	☐ RECOVERED [4]	☑ MODERATE [2]
☐ LOW [2]	☑ FAIR [3]	☐ RECOVERING [3]	☐ LOW [1]
☐ NONE [1]	☐ POOR [1]	☐ RECENT OR NO RECOVERY [1]	

Comments

Channel 14 Maximum 20

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)	RIPARIAN WIDTH (L R)	FLOOD PLAIN QUALITY (L R)	(L R)
☐☐ NONE / LITTLE [3]	☐☐ WIDE > 50m [4]	☐☐ FOREST, SWAMP [3]	☐☐ CONSERVATION TILLAGE [1]
☑☑ MODERATE [2]	☑☑ MODERATE 10-50m [3]	☐☐ SHRUB OR OLD FIELD [2]	☐☐ URBAN OR INDUSTRIAL [0]
☐☐ HEAVY / SEVERE [1]	☐☐ NARROW 5-10m [2]	☑☑ RESIDENTIAL, PARK, NEW FIELD [1]	☐☐ MINING / CONSTRUCTION [0]
	☐☐ VERY NARROW < 5m [1]	☐☐ FENCED PASTURE [1]	Indicate predominant land use(s) past 100m riparian.
	☐☐ NONE [0]	☐☐ OPEN PASTURE, ROWCROP [0]	

Comments

Riparian 6 Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!))	CHANNEL WIDTH (Check ONE (Or 2 & average))	CURRENT VELOCITY (Check ALL that apply)	
☐ > 1m [6]	☑ POOL WIDTH > RIFFLE WIDTH [2]	☐ TORRENTIAL [-1]	☑ SLOW [1]
☑ 0.7-<1m [4]	☐ POOL WIDTH = RIFFLE WIDTH [1]	☐ VERY FAST [1]	☐ INTERSTITIAL [-1]
☐ 0.4-<0.7m [2]	☐ POOL WIDTH < RIFFLE WIDTH [0]	☐ FAST [1]	☐ INTERMITTENT [-2]
☐ 0.2-<0.4m [1]		☑ MODERATE [1]	☐ EDDIES [1]
☐ < 0.2m [0]		Indicate for reach - pools and riffles.	

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current 8 Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH	RUN DEPTH	RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS
☐ BEST AREAS > 10cm [2]	☐ MAXIMUM > 50cm [2]	☐ STABLE (e.g., Cobble, Boulder) [2]	☐ NONE [2]
☐ BEST AREAS 5-10cm [1]	☐ MAXIMUM < 50cm [1]	☑ MOD. STABLE (e.g., Large Gravel) [1]	☐ LOW [1]
☑ BEST AREAS < 5cm [metric=0]	NO RUNS	☐ UNSTABLE (e.g. Fine Gravel, Sand) [0]	☑ MODERATE [0]
			☐ EXTENSIVE [-1]

Comments

Riffle / Run 1 Maximum 8

6] GRADIENT (10.0 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]
DRAINAGE AREA (mi²)

%POOL: 50 %GLIDE: 40
%RUN: 0 %RIFFLE: 10

Gradient 10 Maximum 10

EPA 4520 06/16/06

*- ORIGIN DETERMINED FROM ILLINOIS GEOLOGICAL SURVEY WAUKEGAN QUADRANGLE.

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17 PCSD 68		DATE: 2012-03-29 (YYYY-MM-DD)									
		Grabs									
Transect	Feature Type	1	2	3	4	5	6	7	8	9	10
1	RN	SC	SC	SC	M	M	55	27	9	10	SC
2	P	SC	SC	M	9	47	23	36	SC	SC	SC
3	RF	F	F	SC	10	9	F	100	17	29	SC
4	G	SC	C	F	SC	11	22	5	19	8	12
5	G	SC	SC	SC	CS	CM	CS	65	34	70	41
6	G	SC	6	4	15	8	18	CB	C	C	C
7	RN	C	C	50	22	18	20	30	MC	MC	100
8	P	SC	SC	F	F	SC	SC	SC	SC	SC	SC
9	P	SC	SC	SC	SC	SC	F	C	C	12	20
10	P	F	55	15	20	25	CS	12	SC	SC	SC

CS/CM
COBBLES
MED/SMAL

Abbreviations:

Silt/Clay = SC
Sand – Very Fine = VF
Sand – Fine = F
Sand – Medium = M
Hardpan Clay – = HP
Bedrock – BR = BR
Sand – Coarse = C
Sand – Very = VC
Small Boulder = SB
Medium = MB
Large Boulder = LB

Feature Types:

Riffle = RF
Run = RN
Glide = G
Pool = P

After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

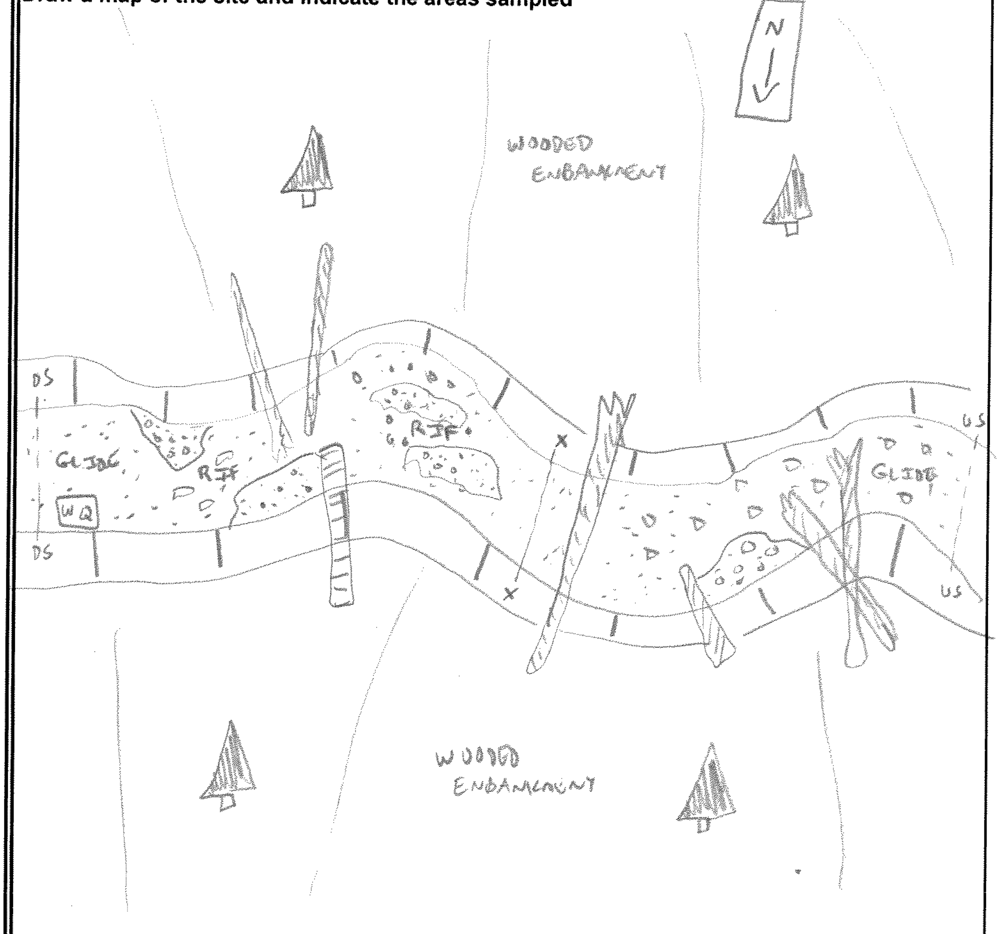
CB

FIELD DATA – LOCATION AND CLIMATE INFORMATION

STREAM NAME UT TO SOUTH BRANCH PETTIBONE CR.		LOCATION NAVAL STATION GREAT LAKES	
STATION # NTC17PCSD69		Latitude 42.30713	
PHOTO #		Longitude 087.84286	
INVESTIGATORS CB, BR, KS			
FORM COMPLETED BY CB		DATE 03-29-2012	REASON FOR SURVEY

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled



STREAM CHARACTERIZATION

Subsystem Classification
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

WEATHER CONDITIONS

Now	Past 24 hours	
☐	☐	storm (heavy rain)
☐	☐	rain (steady rain)
☐	☐	showers (intermittent)
☑ 50 %	☑ 20	%cloud cover
☐	☐	clear/sunny

Has there been a heavy rain in the last 7 days?
☑ Yes ☐ No

Air Temperature 51 °~~C~~F

Other ______

CG

FIELD DATA - PHYSICAL CHARACTERIZATION / WATER QUALITY

RIPARIAN ZONE/ INSTREAM FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☑ Other MILITARY BASE ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Canopy Cover** ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** 1.0* m *DIFFICULT TO DETERMINE DUE TO HEAVY BANK EROSION	**Local Water Erosion** ☐ None ☐ Moderate ☑ Heavy **Estimated Stream Width** 1.4 m **Estimated Stream Depth** ☑ Riffle 0.05 m ☐ Run____ m ☑ Pool 0.40 m **Velocity** 1m=13s m/sec **Estimated Reach Length** 300 FT ~~m~~ **Channelized** ☐ Yes ☑ No **Dam Present** ☐ Yes ☑ No
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** DECIDUOUS	
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating ☐ Floating Algae ☑ Attached Algae **dominant species present** UNKNOWN **Portion of the reach with vegetative cover** 20 %	
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No
WATER QUALITY	**Temperature** 11.61 °C **Specific Conductance** 2.99 mS/cm **Dissolved Oxygen** 12.88 mg/L **pH** 8.02 **Turbidity** 1.1 NTU **WQ Instrument Used** HORIBA	**Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other____ **Water Surface Oils** ☐ Slick ☑ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other____ **Turbidity (if not measured)** ☑ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Water color ☐ Other____

CB

FIELD DATA - BENTHIC MACROINVERTEBRATE SAMPLE

STREAM NAME UT TO SOUTH BRANCH PETTIBONE	STATION # NTC17PCSD69	
Reference or test? TEST		
FORM COMPLETED BY CB	DATE 03-29-2012 TIME 1350	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Cobble 30 % ☑ Snags 40 % ROOTWAD - 10 ☐ Vegetated Banks ____ % ☑ Sand 10 % ☐ Submerged Macrophytes ____ % ☐ Other (DETRITUS) 10 %
SAMPLE COLLECTION	**How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble ____ ☐ Snags ____ ☐ Vegetated Banks ____ ☐ Sand ____ ☐ Submerged Macrophytes ____ ☐ Other ( ) ____
GENERAL COMMENTS	WIDTH <10 FT → 10 BOTTOM, 10 BANK BOTTOM - COARSE - ~~IIII~~ I FINE - II DETRITUS - II BANK - SNAG - ~~IIII~~ III ROOTWAD - II VERY SMALL, LOW FLOW, UNSTABLE, ERODED BANKS

OhioEPA Qualitative Habitat Evaluation Index and Use Assessment Field Sheet — **QHEI Score: 52**

Stream & Location: UT TO SOUTH BRANCH PETTIBONE CREEK **RM:** ___ **Date:** 03/29/2012
NTC17PCS069 **Scorers Full Name & Affiliation:**
River Code: __ **STORET #:** __ **Lat./ Long.:** __ /8__ Office verified location ☑

1] SUBSTRATE Check ONLY Two substrate TYPE BOXES; estimate % or note every type present

BEST TYPES	POOL	RIFFLE	OTHER TYPES	POOL	RIFFLE
☐☐ BLDR /SLABS [10]			☐☐ HARDPAN [4]		|
☐☐ BOULDER [9]			☐☐ DETRITUS [3]	|	
☐☐ COBBLE [8]		|	☐☐ MUCK [2]		
☐☑ GRAVEL [7]	|	|	☐☐ SILT [2]	|	
☑☐ SAND [6]	|	|	☐☐ ARTIFICIAL [0]		
☐☐ BEDROCK [5]			(Score natural substrates; ignore sludge from point-sources)		

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☑ 3 or less [0]

ORIGIN * (Check ONE (Or 2 & average)): ☐ LIMESTONE [1] ☑ TILLS [1] ☐ WETLANDS [0] ☐ HARDPAN [0] ☐ SANDSTONE [0] ☐ RIP/RAP [0] ☐ LACUSTURINE [0] ☐ SHALE [-1] ☐ COAL FINES [-2]

QUALITY — SILT: ☐ HEAVY [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ FREE [1]
EMBEDDEDNESS: ☐ EXTENSIVE [-2] ☑ MODERATE [-1] ☐ NORMAL [0] ☐ NONE [1]

Comments

Substrate **12** Maximum 20

2] INSTREAM COVER Indicate presence 0 to 3: 0-Absent; 1-Very small amounts or if more common of marginal quality; 2-Moderate amounts, but not of highest quality or in small amounts of highest quality; 3-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed rootwad in deep / fast water, or deep, well-defined, functional pools.

0 UNDERCUT BANKS [1]
0 OVERHANGING VEGETATION [1]
2 SHALLOWS (IN SLOW WATER) [1]
0 ROOTMATS [1]
0 POOLS > 70cm [2]
1 ROOTWADS [1]
0 BOULDERS [1]
0 OXBOWS, BACKWATERS [1]
0 AQUATIC MACROPHYTES [1]
2 LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONE (Or 2 & average)): ☐ EXTENSIVE >75% [11] ☑ MODERATE 25-75% [7] ☐ SPARSE 5-<25% [3] ☐ NEARLY ABSENT <5% [1]

Comments

Cover **10** Maximum 20

3] CHANNEL MORPHOLOGY Check ONE in each category (Or 2 & average)

SINUOSITY: ☐ HIGH [4] ☐ MODERATE [3] ☑ LOW [2] ☐ NONE [1]
DEVELOPMENT: ☐ EXCELLENT [7] ☐ GOOD [5] ☐ FAIR [3] ☑ POOR [1]
CHANNELIZATION: ☑ NONE [6] ☐ RECOVERED [4] ☐ RECOVERING [3] ☐ RECENT OR NO RECOVERY [1]
STABILITY: ☐ HIGH [3] ☐ MODERATE [2] ☑ LOW [1]

Comments

Channel **10** Maximum 20

4] BANK EROSION AND RIPARIAN ZONE Check ONE in each category for EACH BANK (Or 2 per bank & average)
River right looking downstream

EROSION (L R): ☐☐ NONE / LITTLE [3] ☐☐ MODERATE [2] ☑☑ HEAVY / SEVERE [1]
RIPARIAN WIDTH (L R): ☐☐ WIDE > 50m [4] ☑☑ MODERATE 10-50m [3] ☐☐ NARROW 5-10m [2] ☐☐ VERY NARROW < 5m [1] ☐☐ NONE [0]
FLOOD PLAIN QUALITY (L R): ☐☐ FOREST, SWAMP [3] ☐☐ SHRUB OR OLD FIELD [2] ☑☑ RESIDENTIAL, PARK, NEW FIELD [1] ☐☐ FENCED PASTURE [1] ☐☐ OPEN PASTURE, ROWCROP [0] ☐☐ CONSERVATION TILLAGE [1] ☐☐ URBAN OR INDUSTRIAL [0] ☐☐ MINING / CONSTRUCTION [0]
Indicate predominant land use(s) past 100m riparian.

Comments

Riparian **5** Maximum 10

5] POOL / GLIDE AND RIFFLE / RUN QUALITY

MAXIMUM DEPTH (Check ONE (ONLY!)): ☐ > 1m [6] ☐ 0.7-<1m [4] ☑ 0.4-<0.7m [2] ☐ 0.2-<0.4m [1] ☐ < 0.2m [0]
CHANNEL WIDTH (Check ONE (Or 2 & average)): ☑ POOL WIDTH > RIFFLE WIDTH [2] ☐ POOL WIDTH = RIFFLE WIDTH [1] ☐ POOL WIDTH > RIFFLE WIDTH [0]
CURRENT VELOCITY (Check ALL that apply): ☐ TORRENTIAL [-1] ☐ VERY FAST [1] ☐ FAST [1] ☐ MODERATE [1] ☑ SLOW [1] ☐ INTERSTITIAL [-1] ☐ INTERMITTENT [-2] ☐ EDDIES [1]
Indicate for reach - pools and riffles.

Recreation Potential: Primary Contact / Secondary Contact (circle one and comment on back)

Comments

Pool / Current **5** Maximum 12

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species: Check ONE (Or 2 & average). ☐ NO RIFFLE [metric=0]

RIFFLE DEPTH: ☐ BEST AREAS > 10cm [2] ☐ BEST AREAS 5-10cm [1] ☑ BEST AREAS < 5cm [metric=0]
RUN DEPTH: ☐ MAXIMUM > 50cm [2] ☐ MAXIMUM < 50cm [1] NO RUNS
RIFFLE / RUN SUBSTRATE: ☐ STABLE (e.g., Cobble, Boulder) [2] ☐ MOD. STABLE (e.g., Large Gravel) [1] ☑ UNSTABLE (e.g., Fine Gravel, Sand) [0]
RIFFLE / RUN EMBEDDEDNESS: ☐ NONE [2] ☐ LOW [1] ☑ MODERATE [0] ☐ EXTENSIVE [-1]

Comments

Riffle / Run **0** Maximum 8

6] GRADIENT (10.5 ft/mi) ☐ VERY LOW - LOW [2-4] ☑ MODERATE [6-10] ☐ HIGH - VERY HIGH [10-6]
DRAINAGE AREA (mi²)

%POOL: 60 %GLIDE: 10
%RUN: 0 %RIFFLE: 30

Gradient **10** Maximum 10

EPA 4520 06/16/06

*- ORIGIN DETERMINED FROM ILLINOIS STATE GEOLOGICAL SURVEY WAUKEGAN QUADRANGLE.

Reviewed By: CB

Page 1 of 1

PEBBLE COUNT FIELD DATA SHEET

SITE ID: NTC17PCSD 69

DATE: 2012-03-29 (YYYY-MM-DD)

Transect	Feature Type	Grabs 1	2	3	4	5	6	7	8	9	10
1	RF	32	25	6	40	33	20	30	15	33	HP
2	RF	27	17	25	25	30	21	4	16	63	SC
3	G	HP	HP	HP	31	42	33	23	11	22	10
4	P	30	38	35	64	21	28	9	34	C	C
5	RF	16	28	24	47	33	29	35	C	C	R
6	G	SC	SC	SC	SC	C	M	M	18	20	C
7	RF	42	45	65	42	40	40	40	32	SC	SC
8	P	30	40	110	F	SC	HP	10	6	M	SC
9	G	SC	15	C	C	C	100	30	22	C	9
10	RF	MC	MC	75	40	VC	8	6	22	45	55

MC = Med cobble

Abbreviations:

Silt/Clay = SC
Sand – Very Fine = VF
Sand – Fine = F
Sand – Medium = M
Hardpan Clay – = HP
Bedrock – BR = BR
Sand – Coarse = C
Sand – Very = VC
Small Boulder = SB
Medium = MB
Large Boulder = LB

Feature Types:

Riffle = RF
Run = RN
Glide = G
Pool = P

After recording transects above transcribe data into table below. Usually done by data entry person.

Size Class		Size (mm)	Feature	Number	Feature	Number	Feature	Number	Total (for all features)	Cumulative Total (for all sizes)
Silt/Clay		< 0.062								
Sand	Very Fine	0.062-0.125								
	Fine	0.125-0.25								
	Medium	0.25-0.50								
	Coarse	0.50-1.0								
	Very Coarse	1.0-2.0								
Gravel	Very Fine	2-4								
	Fine	4-6								
		6-8								
	Medium	8-12								
		12-16								
	Coarse	16-24								
		24-32								
	Very Coarse	32-48								
		48-64								
Cobble	Small	64-96								
		96-128								
	Large	128-192								
		192-256								
Boulder	Small	256-384								
		384-512								
	Medium	512-1024								
	Large - Very Large	1024-4096								
Bedrock		> 4096								

Appendix B. Site Photos


Figure C-1. Test site SD 53 looking upstream (left photo) and downstream (right).


Figure C-2. Test site SD 54 looking upstream (left photo) and downstream (right).


Figure C-3. Tributary test site SD 58 looking upstream (left photo) and downstream (right).

Figure C-4. Test site SD 59 looking upstream (left photo) and downstream (right).

Figure C-5. Test site SD 60 looking upstream (left photo) and downstream (right).

Figure C-6. Test site SD 61 looking upstream (left photo) and downstream (right).

Figure C-7. Test site SD 62 looking upstream (left photo) and downstream (right).

Figure C-8. Test site SD 63 looking upstream (left photo) and downstream (right).

Figure C-9. Test site SD 64 looking upstream (left photo) and downstream (right).


Figure C-10. Reference site SD 65 looking upstream (left photo) and downstream (right).


Figure C-11. Reference site SD 66 looking upstream (left photo) and downstream (right).


Figure C-12. Reference site SD 67 looking upstream (left photo) and downstream (right).

Figure C-13. Reference site SD 68 looking upstream (left photo) and downstream (right).

Figure C-14. Tributary reference site SD 69 looking upstream (left photo) and downstream (right).

Appendix C

Taxonomic Data Quality Control Report

TETRA TECH

Taxonomic Data Quality Control Report

Report completed (date)	April 27, 2012
Tetra Tech project number	100-BLT-T28932-01
Project name	Sediment Characterization Investigation in Support of the Feasibility Study for Site 17 - Pettibone Creek
Client	Naval Facilities Engineering Command-Midwest **(**NAVFAC), Naval Station-Great Lakes (Tetra Tech-NUS, Pittsburgh)
Client contact	Mr. Robert Davis ([412] 921-7251), Mr. Aaron Bernhardt ([412] 921-8433)
Primary taxonomist(s)	Todd Askegaard (Aquatic Resources Center)
QC taxonomist(s)	Mike Winnell (Freshwater Benthic Services)
QC analyst	J. Stribling

Table of contents

***Prepared by*: Tetra Tech, Inc., Center for Ecological Sciences, 400 Red Brook Blvd., Suite 200, Owings Mills, Maryland 21117-5159 (with questions, contact James Stribling [410-356-8993], or james.stribling@tetratech.com)**

Taxonomic Data Quality Control Report

Report completed (date)	April 27, 2012
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Client	Naval Facilities Engineering Command-Midwest (NAVFAC), Naval Station-Great Lakes (Tetra Tech-NUS, Pittsburgh)
Client contact	Mr. Robert Davis (Tt) ([412] 921-7251), Mr. Aaron Bernhardt (Tt) ([412] 921-8433)
Primary taxonomist(s)	Todd Askegaard (Aquatic Resources Center)
QC taxonomist(s)	Mike Winnell (Freshwater Benthic Services)
QC analyst	J. Stribling

Test conditions and narrative summary – Three (3) benthic macroinvertebrate samples were randomly selected from the full sample lot of 14. These results represent a direct comparison of identification results by independent taxonomists in separate laboratories; all primary identifications (n=14 samples) were done by Aquatic Resources Center (ARC); the QC re-identifications were done on the three samples by Freshwater Benthic Services (FBS). Summary values for means and standard deviations are based on 3 samples (n=3), and thus, are representative of the overall dataset. The mean percent taxonomic disagreement (PTD) is 4.4, substantially better than the typical 15% measurement quality objective (MQO) used for many programs; and the mean percent difference in enumeration (PDE) was 0.8, as compared to the programmatic MQO of 5%. Overall, the comparisons were excellent, with substantial consistency (good precision, low PTD). No (zero) samples exceeded the PTD_{MQO} or PDE_{MQO}. The overall data quality of the dataset is acceptable for additional analyses.

Standard operating procedures (SOP) for identifications documented and provided to all primary and QC taxonomists? Yes, as part of the scope of work.

Additional comments: None.

Hierarchical target levels

Identify all benthic macroinvertebrates to the lowest practical taxonomic level. The target levels are at least genus for insects and non-sphaeriid/non-unionid bivalves; identify the remaining macroinvertebrates as Hirudinea, Oligochaeta, Turbellaria, Unionidae, Cambariidae, and Sphaeriidae.

TETRA TECH

SUMMARY STATISTICS (by sample lot)

Number of samples in lot		14
Number of samples tested		3
Percent of sample lot		21.4%
Percent taxonomic disagreement (PTD)		
	Average	4.4
	Standard deviation	2.1
	Measurement quality objective	15
	No. samples exceeding	0
Percent difference in enumeration (PDE)		
	Average	0.8
	Standard deviation	0.6
	Measurement quality objective	5
	No. samples exceeding	0
Percent taxonomic completeness (PTC_absolute difference)		
	Average	1.6
	Standard deviation	2.2
	Measurement quality objective	none specified
	No. samples exceeding	not applicable

The following provides definitions for abbreviations and column headers in tables found in subsequent pages:

Column	Abbreviations	Definition
A	**no_ind_T1**	number of individuals counted by primary taxonomist
B	**no_ind_T2**	number of individuals counted by QC taxonomist
C	**Matches**	number of agreements between the two taxonomists
D	**PDE**	percent difference in enumeration
E	**PTD**	percent taxonomic disagreement
F	**Target_T1**	number of individuals identified to target level, primary taxonomist
G	**Target_T2**	number of individuals identified to target level, QC taxonomist
H	**PTC_T1**	percent taxonomic completeness, primary taxonomist
I	**PTC_T2**	percent taxonomic completeness, QC taxonomist
J	**PTC (abs diff)**	percent taxonomic completeness (absolute difference)
K	**Diff_Strt**	number of straight taxonomic disagreements
L	**Diff_Hier**	number of hierarchical differences
M	**Diff_Miss**	number of missing specimens

SUMMARY STATISTICS (by individual samples)

Sample ID	A	B	C	D	E	F	G	H	I	J
SD59	286	292	284	1	2.7	284	289	99.3	99	0.3
SD61	270	269	252	0.2	6.7	268	256	99.3	95.2	4.1
SD62	262	269	259	1.3	3.7	260	266	99.2	98.9	0.3

TAXON BY TAXON COMPARISONS (within samples)

Sample ID	Taxon	A	B	C	K	L	M
SD59	Acanthocephala	0	2	0	0	0	2
SD59	Nematoda	1	1	1	0	0	0
SD59	Sperchon	9	9	9	0	0	0
SD59	Oligochaeta	164	168	164	0	0	4
SD59	Prostoma	1	1	1	0	0	0
SD59	Physa	0	1	0	0	1	0
SD59	Physidae	1	0	0	0	0	0
SD59	Calopteryx	4	4	4	0	0	0
SD59	Girardia	0	12	12	0	0	0
SD59	Dugesiidae	16	4	4	0	0	0
SD59	Crangonyx	1	1	1	0	0	0
SD59	Caecidotea	12	12	12	0	0	0
SD59	Chaetocladius	1	1	1	0	0	0
SD59	Chironomus	4	5	4	1	0	0
SD59	Cricotopus/Orthocladius	13	12	12	0	0	0
SD59	Cryptochironomus	7	7	7	0	0	0
SD59	Limnophyes	4	4	4	0	0	0
SD59	Orthocladius	0	1	1	0	0	0
SD59	Phaenopsectra	2	2	2	0	0	0
SD59	Polypedilum	24	23	23	0	0	0
SD59	Thienemannimyia genus gr.	15	15	15	0	0	0
SD59	Neoplasta	2	2	2	0	0	0
SD59	Hydropsyche	5	5	5	0	0	0
SD61	Caecidotea	22	25	22	0	0	0
SD61	Calopteryx	18	11	11	0	0	0
SD61	Calopterygidae	0	7	0	0	7	0
SD61	Bezzia/Palpomyia	1	1	1	0	0	0
SD61	Chaetocladius	1	1	1	0	0	0
SD61	Chironomidae	0	1	0	0	0	1
SD61	Chironomus	4	4	4	0	0	0
SD61	Cricotopus/Orthocladius	49	44	44	0	0	0
SD61	Cryptochironomus	4	4	4	0	0	0
SD61	Limnophyes	1	1	1	0	0	0
SD61	Orthocladiini	0	3	0	0	3	0
SD61	Phaenopsectra	4	4	4	0	0	0

TETRA TECH

Sample ID	Taxon	A	B	C	K	L	M
SD61	Polypedilum	14	14	14	0	0	0
SD61	Stenochironomus	2	2	2	0	0	0
SD61	Thienemannimyia genus gr.	25	25	25	0	0	0
SD61	Crangonyx	20	20	20	0	0	0
SD61	Girardia	0	22	22	0	0	1
SD61	Dugesiidae	27	4	4	0	0	0
SD61	Hemerodromia	1	1	1	0	0	0
SD61	Neoplasta	1	1	1	0	0	0
SD61	Cheumatopsyche	1	3	1	2	0	0
SD61	Hydropsyche	7	6	6	0	0	0
SD61	Hydropsychidae	1	0	0	0	1	0
SD61	Pericoma	1	0	1	0	0	0
SD61	Pericoma/Telmatoscopus	0	1	0	0	0	0
SD61	Sperchon	23	23	23	0	0	0
SD61	Prostoma	2	2	2	0	0	0
SD61	Tipula	1	1	1	0	0	0
SD61	Acanthocephala	1	2	1	0	0	1
SD61	Oligochaeta	39	36	36	0	0	3
SD62	Acanthocephala	2	2	2	0	0	0
SD62	Sperchon	6	6	6	0	0	0
SD62	Pisidium	1	1	1	0	0	0
SD62	Oligochaeta	122	126	122	0	0	4
SD62	Calopteryx	4	3	3	0	1	0
SD62	Girardia	0	5	2	0	0	3
SD62	Dugesiidae	6	4	4	0	0	0
SD62	Crangonyx	2	2	2	0	0	0
SD62	Caecidotea	8	8	8	0	0	0
SD62	Stenelmis	5	5	5	0	0	0
SD62	Dasyhelea	1	1	1	0	0	0
SD62	Chaetocladius	2	2	2	0	0	0
SD62	Chironomus	3	2	2	1	0	0
SD62	Cricotopus/Orthocladius	46	39	39	0	0	0
SD62	Cryptochironomus	2	2	2	0	0	0
SD62	Limnophyes	5	5	5	0	0	0
SD62	Orthocladius	0	7	7	0	0	0
SD62	Paratanytarsus	6	5	5	0	0	0
SD62	Paratendipes	1	1	1	0	0	0
SD62	Phaenopsectra	4	4	4	0	0	0
SD62	Polypedilum	4	5	4	0	0	0
SD62	Psectrocladius	1	1	1	0	0	0
SD62	Rheotanytarsus	0	1	0	1	0	0
SD62	Tanytarsini	1	1	1	0	0	0
SD62	Tanytarsus	6	6	6	0	0	0
SD62	Thienemannimyia genus gr.	17	17	17	0	0	0
SD62	Zavrelimyia	1	1	1	0	0	0

Sample ID	Taxon	A	B	C	K	L	M
SD62	Hemerodromia	3	3	3	0	0	0
SD62	Neoplasta	2	2	2	0	0	0
SD62	Calopterygidae	0	1	0	0	1	0
SD62	Hydropsyche	1	1	1	0	0	0

List of corrective actions or other issues

1. No substantial corrective actions necessary or required

Appendix D.
Benthic macroinvertebrate sample processing information and data.

Table A-1. Sample processing log: sorting and subsampling results.

	Sort		Grids out of 30		Numbers of individuals				
Sample Id	Date	Ana-lyst	Tray 1	Tray 2	Oligo-chaeta	Chiro-nomidae	Mollusca	Crustacea	Others
SD53	4-Apr	twa	5	--	89	181	2	6	23
SD54	4-Apr	rth	4	--	65	145	0	3	65
SD58	3-Apr	twa	7	--	242	32	0	4	46
SD59	2-Apr	rth	4	28	171	68	1	14	47
SD60	4-Apr	rth	10	--	100	99	1	25	54
SD61	3-Apr	rth	10	--	28	93	0	118	89
SD62	2-Apr	twa	7	--	128	100	1	10	31
SD63	1-Apr	rth	4	--	201	81	0	27	37
SD64	1-Apr	twa	4	12	216	60	0	5	16
SD65	2-Apr	twa	4	16	156	88	0	9	30
SD66	2-Apr	rth	4	--	188	91	16	13	34
SD67	31-Mar	rth	4	22	105	91	22	14	36
SD68	31-Mar	twa	4	14	56	167	8	12	30
SD69	1-Apr	rth	4	24	187	33	2	52	20

Table A-2. Taxonomic identification results: Taxa lists, by sampling station. Life stage is only noted for those organisms that have both larval (L) and adult (A) aquatic stages.

Taxon	No.	Stage
SampleID: SD53. RefTest: Test. Sample Date: 3/28/2012		
Gyraulus	1	
Physidae	1	
Caecidotea	7	
Prostoma	2	
Dugesiidae	9	
Boyeria	2	
Calopteryx	4	
Noctuidae	1	
Bezzia/Palpomyia	1	
Pericoma	1	
Polypedilum	8	
Cryptochironomus	8	
Paratanytarsus	4	

Taxon	No.	Stage
Limnophyes	4	
Cricotopus	92	
Eukiefferiella	2	
Thienemannimyia gr.	5	
Cricotopus/Orthocladius	52	
Zavrelimyia	2	
Chironomus	4	
Nais	17	
Tubificinae:bifid chaetae	25	
Tubificinae:hair+pectinate chaetae	23	
Enchytraeidae	5	
Quistadrilus	3	
Potamothrix	2	
Limnodrilus	14	
SampleID: SD54. RefTest: Test. Sample Date: 3/28/2012		
Caecidotea	3	
Nematoda	2	
Prostoma	4	
Dugesiidae	25	
Sperchon	22	
Boyeria	3	
Calopteryx	5	
Hydropsyche	1	
Curculionidae	1	L
Polypedilum	18	
Cricotopus/Orthocladius	44	
Limnophyes	2	
Phaenopsectra	4	
Chironomus	7	
Cryptochironomus	5	
Cricotopus	55	
Thienemannimyia gr.	8	
Tanytarsini	1	
Paratanytarsus	1	
Zavrelimyia	1	
Psychodidae	1	
Nais	13	
Paranais	1	
Tubificinae:hair+pectinate chaetae	2	
Enchytraeidae	12	

Taxon	No.	Stage
Pristina	1	
Limnodrilus	27	
Potamothrix	3	
Quistadrilus	1	
Tubificinae:bifid chaetae	2	
SampleID: SD58. RefTest: Test Trib. Sample Date: 3/29/2012		
Crangonyx	1	
Caecidotea	3	
Prostoma	1	
Dugesiidae	29	
Calopteryx	4	
Erioptera	1	
Cricotopus/Orthocladius	7	
Polypedilum	8	
Limnophyes	2	
Phaenopsectra	1	
Stenochironomus	10	
Thienemannimyia gr.	4	
Nais	169	
Enchytraeidae	17	
Tubificinae:hair+pectinate chaetae	6	
Limnodrilus	17	
Tubificinae:bifid chaetae	23	
Potamothrix	4	
Tubifex	1	
SampleID: SD59. RefTest: Test. Sample Date: 3/28/2012		
Physidae	1	
Crangonyx	1	
Caecidotea	12	
Nematoda	1	
Prostoma	1	
Dugesiidae	16	
Sperchon	9	
Calopteryx	4	
Hydropsyche	5	
Neoplasta	2	
Polypedilum	24	
Limnophyes	4	
Phaenopsectra	2	
Cryptochironomus	7	
Cricotopus/Orthocladius	9	

Taxon	No.	Stage
Thienemannimyia gr.	15	
Chironomus	4	
Cricotopus	4	
Chaetocladius	1	
Paranais	79	
Nais	42	
Pristina	1	
Tubificinae:bifid chaetae	11	
Enchytraeidae	9	
Tubificinae:hair+pectinate chaetae	10	
Potamothrix	1	
Limnodrilus	8	
Lumbriculidae	1	
Tubifex	1	
Quistadrilus	1	
SampleID: SD60. RefTest: Test. Sample Date: 3/28/2012		
Lymnaeidae	1	
Crangonyx	4	
Caecidotea	21	
Nematoda	1	
Prostoma	2	
Dugesiidae	16	
Sperchon	6	
Calopteryx	5	
Hydropsyche	14	
Tipula	1	
Polypedilum	20	
Cricotopus/Orthocladius	24	
Sciaridae	1	
Tanytarsus	1	
Chironomus	7	
Cryptochironomus	16	
Cricotopus	5	
Phaenopsectra	2	
Eukiefferiella	1	
Thienemannimyia gr.	22	
Limnophyes	1	
Paratanytarsus	1	
Chironominae	1	
Paranais	22	
Nais	32	

Taxon	No.	Stage
Tubificinae:hair+pectinate chaetae	4	
Enchytraeidae	4	
Tubificinae:bifid chaetae	12	
Acanthocephala	4	
Quistadrilus	1	
Limnodrilus	4	
Bothrioneurum	1	
SampleID: SD61. RefTest: Test. Sample Date: 3/28/2012		
Crangonyx	20	
Caecidotea	22	
Prostoma	2	
Dugesiidae	27	
Sperchon	23	
Calopteryx	18	
Cheumatopsyche	1	
Hydropsyche	7	
Hydropsychidae	1	
Bezzia/Palpomyia	1	
Hemerodromia	1	
Neoplasta	1	
Tipula	1	
Pericoma	1	
Polypedilum	14	
Chaetocladius	1	
Phaenopsectra	4	
Cryptochironomus	4	
Stenochironomus	2	
Cricotopus/Orthocladius	47	
Cricotopus	2	
Chironomus	4	
Thienemannimyia gr.	25	
Limnophyes	1	
Paranais	5	
Tubificinae:bifid chaetae	6	
Nais	10	
Tubificinae:hair+pectinate chaetae	3	
Enchytraeidae	8	
Acanthocephala	1	
Limnodrilus	5	
Potamothrix	1	

Taxon	No.	Stage
Quistadrilus	1	
SampleID: SD62. RefTest: Test. Sample Date: 3/27/2012		
Pisidium	1	
Crangonyx	2	
Caecidotea	8	
Dugesiidae	6	
Sperchon	6	
Calopteryx	4	
Hydropsyche	1	
Stenelmis	5	3L, 2A
Hemerodromia	3	
Neoplasta	2	
Tanytarsus	6	
Paratanytarsus	6	
Phaenopsectra	4	
Polypedilum	4	
Paratendipes	1	
Chironomus	3	
Dasyhelea	1	
Cryptochironomus	2	
Chaetocladius	2	
Cricotopus/Orthocladius	38	
Limnophyes	5	
Cricotopus	8	
Psectrocladius	1	
Thienemannimyia gr.	17	
Zavrelimyia	1	
Tanytarsini	1	
Nais	95	
Enchytraeidae	11	
Paranais	1	
Tubificinae:bifid chaetae	7	
Tubifex	1	
Limnodrilus	7	
Acanthocephala	2	
SampleID: SD63. RefTest: Test. Sample Date: 3/27/2012		
Crangonyctidae	1	
Caecidotea	24	
Nematoda	1	
Prostoma	2	
Dugesiidae	10	

Taxon	No.	Stage
Sperchon	2	
Boyeria	1	
Calopteryx	5	
Cheumatopsyche	1	
Hydropsyche	1	
Stenelmis	9	L
Hemerodromia	1	
Tipula	1	
Polypedilum	2	
Paratendipes	1	
Phaenopsectra	4	
Cryptochironomus	8	
Chironomus	1	
Paratanytarsus	9	
Cricotopus/Orthocladius	28	
Cricotopus	6	
Diamesa	1	
Psectrocladius	2	
Stictochironomus	1	
Tanypodinae	1	
Thienemannimyia gr.	13	
Orthocladiinae	1	
Tanytarsus	1	
Chaetocladius	1	
Nais	140	
Paranais	8	
Tubificinae:hair+pectinate chaetae	2	
Limnodrilus	2	
Enchytraeidae	6	
Tubificinae:bifid chaetae	4	
SampleID: SD64. RefTest: Test. Sample Date: 3/27/2012		
Crangonyx	1	
Caecidotea	4	
Prostoma	1	
Dugesiidae	3	
Calopteryx	4	
Cheumatopsyche	1	
Hydropsyche	3	
Hydropsychidae	2	
Stenelmis	1	L
Tanytarsus	4	

Taxon	No.	Stage
Paratanytarsus	3	
Polypedilum	5	
Phaenopsectra	9	
Paratendipes	1	
Cryptochironomus	5	
Chironomus	4	
Cricotopus	2	
Cricotopus/Orthocladius	10	
Stenochironomus	1	
Diamesa	2	
Stictochironomus	3	
Thienemannimyia gr.	8	
Zavrelimyia	1	
Chironominae	1	
Nais	156	
Tubificinae:bifid chaetae	17	
Limnodrilus	19	
Paranais	10	
Enchytraeidae	4	
Tubificinae:hair+pectinate chaetae	4	
SampleID: SD65. RefTest: Ref. Sample Date: 3/29/2012		
Caecidotea	9	
Dugesiidae	4	
Calopteryx	1	
Cheumatopsyche	4	
Hydropsyche	6	
Stenelmis	15	12L,3A
Dasyhelea	1	Z6
Cryptochironomus	2	
Polypedilum	2	
Cricotopus/Orthocladius	29	
Chaetocladius	9	
Paratanytarsus	4	
Tanytarsus	7	
Phaenopsectra	6	
Limnophyes	1	
Nanocladius	1	
Cricotopus	5	
Rheocricotopus	1	
Diamesa	8	
Thienemannimyia gr.	13	

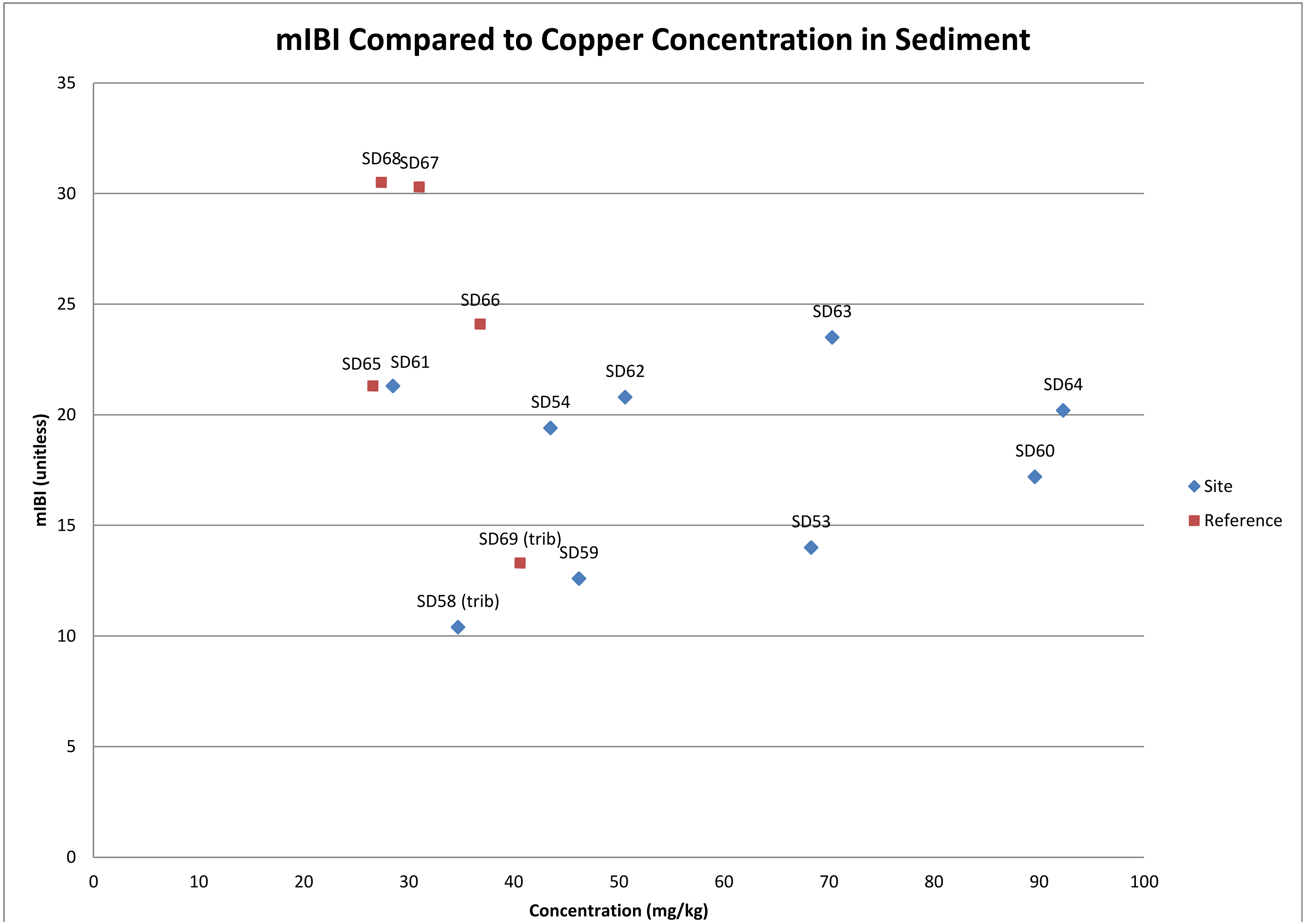
Taxon	No.	Stage
Nais	151	
Enchytraeidae	1	
SampleID: SD66. RefTest: Ref. Sample Date: 3/29/2012		
Pisidium	12	
Ferrissia	4	
Caecidotea	13	
Nematoda	2	
Dugesiidae	2	
Helobdella	1	
Boyeria	1	
Calopteryx	2	
Ischnura	1	
Cheumatopsyche	4	
Hydropsyche	7	
Stenelmis	14	10L, 4A
Chaetocladius	19	
Cricotopus/Orthocladius	15	
Micropsectra	3	
Eukiefferiella	1	
Polypedilum	2	
Paratanytarsus	3	
Phaenopsectra	4	
Tanytarsus	3	
Cryptochironomus	3	
Cricotopus	2	
Diamesa	17	
Psectrocladius	2	
Trichoceridae	1	
Thienemannimyia gr.	15	
Ablabesmyia	1	
Nais	149	
Limnodrilus	5	
Enchytraeidae	2	
Chaetogaster	1	
Tubificinae:bifid chaetae	2	
Quistadrilus	2	
Tubificinae:hair+pectinate chaetae	1	
Ilyodrilus	1	
Acanthocephala	1	
SampleID: SD67. RefTest: Ref. Sample Date: 3/29/2012		
Pisidium	12	

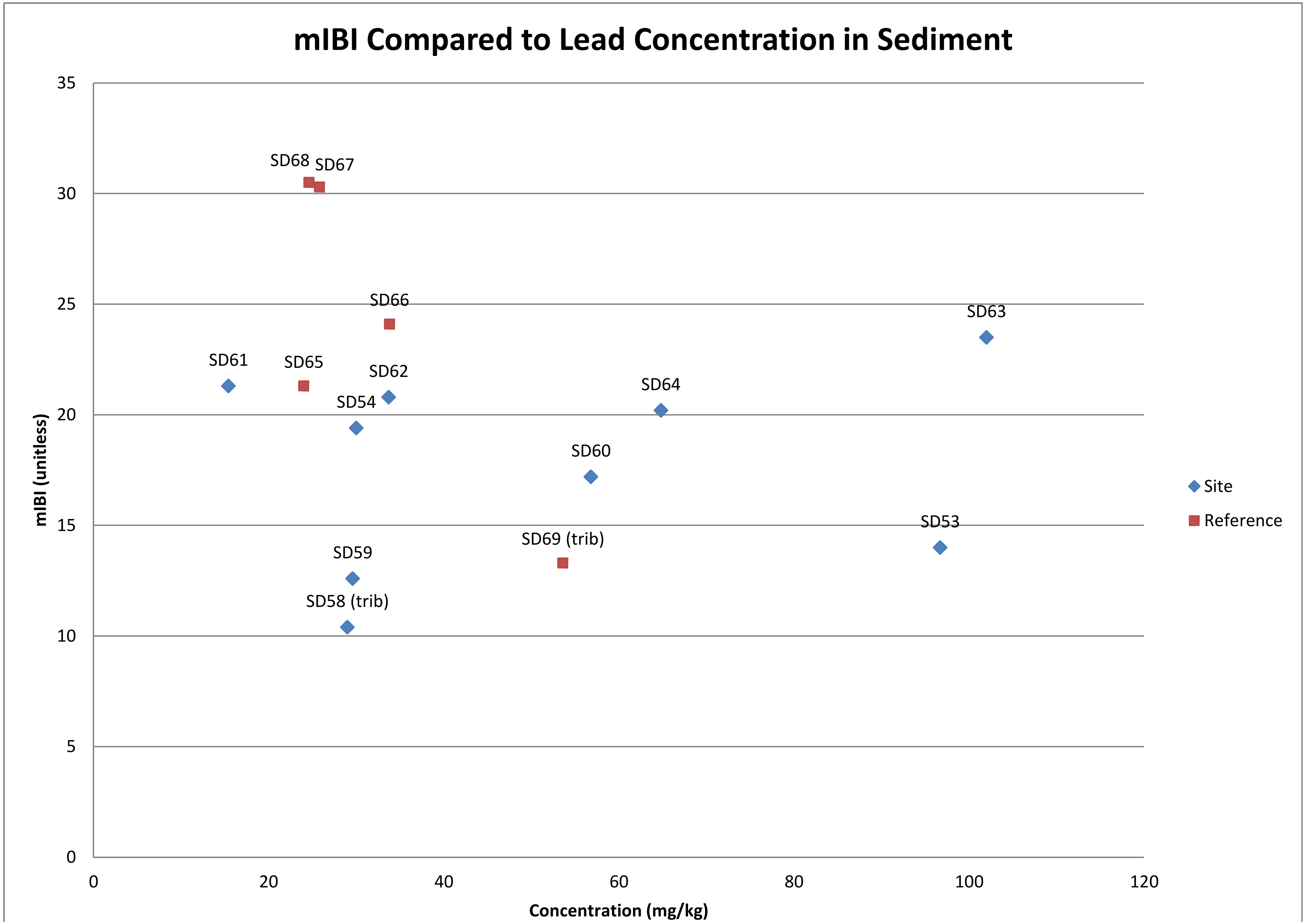
Taxon	No.	Stage
Sphaerium	1	
Sphaeriidae	3	
Ferrissia	5	
Stagnicola	2	
Caecidotea	14	
Nematoda	1	
Prostoma	2	
Dugesiidae	1	
Helobdella	1	
Sperchon	1	
Boyeria	1	
Cheumatopsyche	7	
Hydropsyche	2	
Stenelmis	15	9L, 6A
Limonia	1	
Ephydra	2	
Paratendipes	3	
Cricotopus/Orthocladius	30	
Micropsectra	4	
Tanytarsus	9	
Paratanytarsus	2	
Cryptochironomus	6	
Dicrotendipes	1	
Phaenopsectra	4	
Chaetocladius	6	
Diamesa	9	
Cricotopus	7	
Limnophyes	1	
Thienemannimyia gr.	4	
Psectrocladius	1	
Nais	80	
Chaetogaster	1	
Enchytraeidae	5	
Quistadrilus	1	
Limnodrilus	2	
Acanthocephala	1	
SampleID: SD68. RefTest: Ref. Sample Date: 3/29/2012		
Pisidium	4	
Ferrissia	2	
Physa	2	
Caecidotea	12	

Taxon	No.	Stage
Nematoda	5	
Dugesiidae	4	
Boyeria	2	
Calopteryx	2	
Coenagrionidae	1	
Cheumatopsyche	2	
Stenelmis	14	8L, 6A
Psychoda	1	
Chaetocladius	19	
Polypedilum	2	
Micropsectra	16	
Cricotopus/Orthocladius	28	
Phaenopsectra	11	
Cryptochironomus	6	
Tanytarsus	20	
Paratanytarsus	18	
Paratendipes	2	
Cricotopus	15	
Parachironomus	1	
Paraphaenocladius	1	
Psectrocladius	6	
Diamesa	5	
Thienemannimyia gr.	13	
Stictochironomus	1	
Ablabesmyia	1	
Tubificinae:bifid chaetae	9	
Nais	29	
Tubificinae:hair+pectinate chaetae	2	
Enchytraeidae	5	
Limnodrilus	4	
Quistadrilus	1	
Tubifex	2	
SampleID: SD69. RefTest: Ref Trib. Sample Date: 3/29/2012		
Physa	2	
Caecidotea	51	
Prostoma	5	
Dugesiidae	3	
Calopteryx	4	
Cheumatopsyche	2	
Hydropsyche	5	
Agabus	1	L

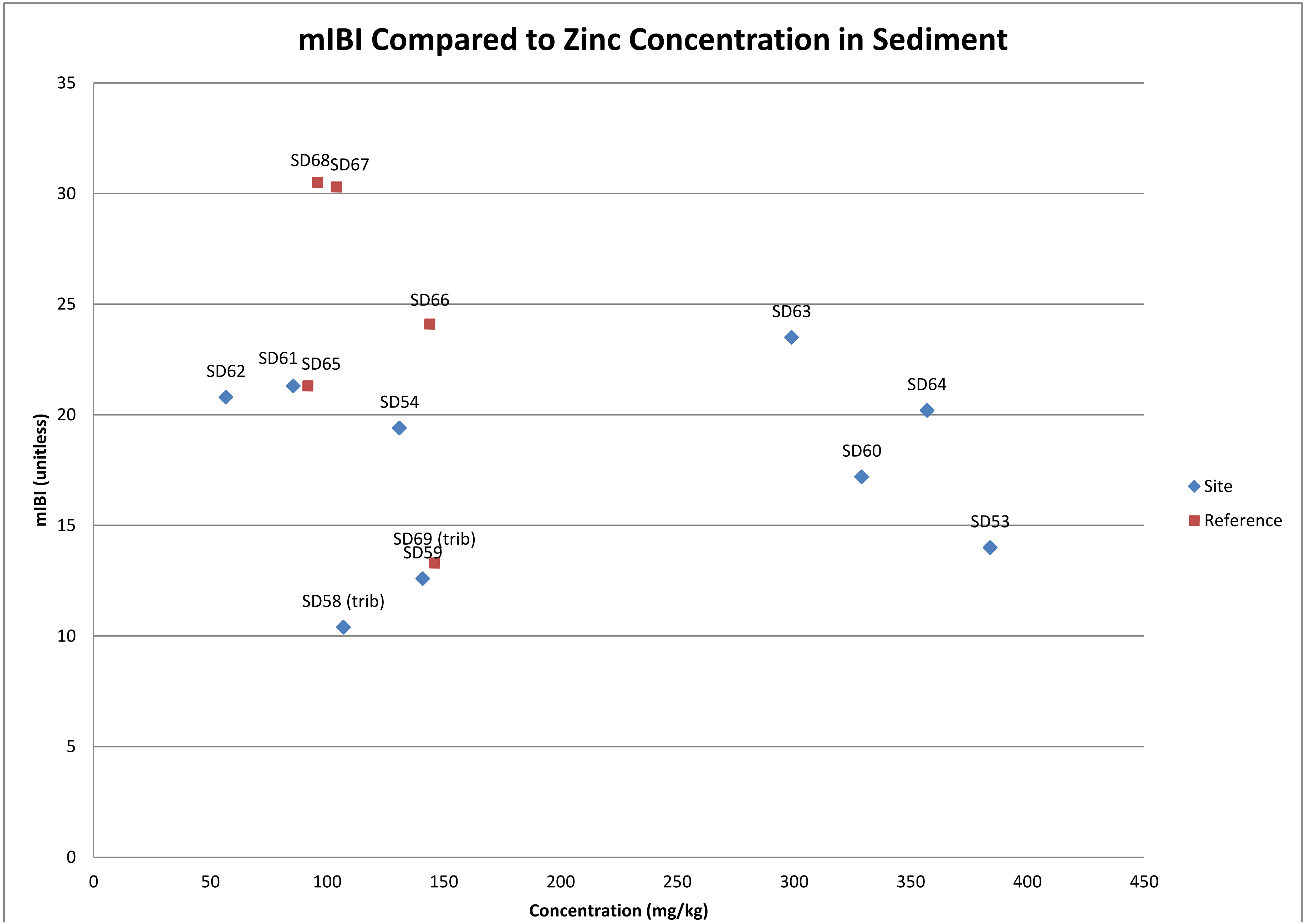
Taxon	No.	Stage
Cryptochironomus	3	
Phaenopsectra	7	
Paratanytarsus	1	
Cricotopus	1	
Limnophyes	4	
Cricotopus/Orthocladius	7	
Chaetocladius	1	
Thienemannimyia gr.	8	
Nais	139	
Tubificinae:hair+pectinate chaetae	5	
Enchytraeidae	2	
Limnodrilus	7	
Tubificinae:bifid chaetae	5	
Tubifex	1	

PLOTS OF BENTHIC COMMUNITY METRICS VERSUS SEDIMENT CONCENTRATIONS

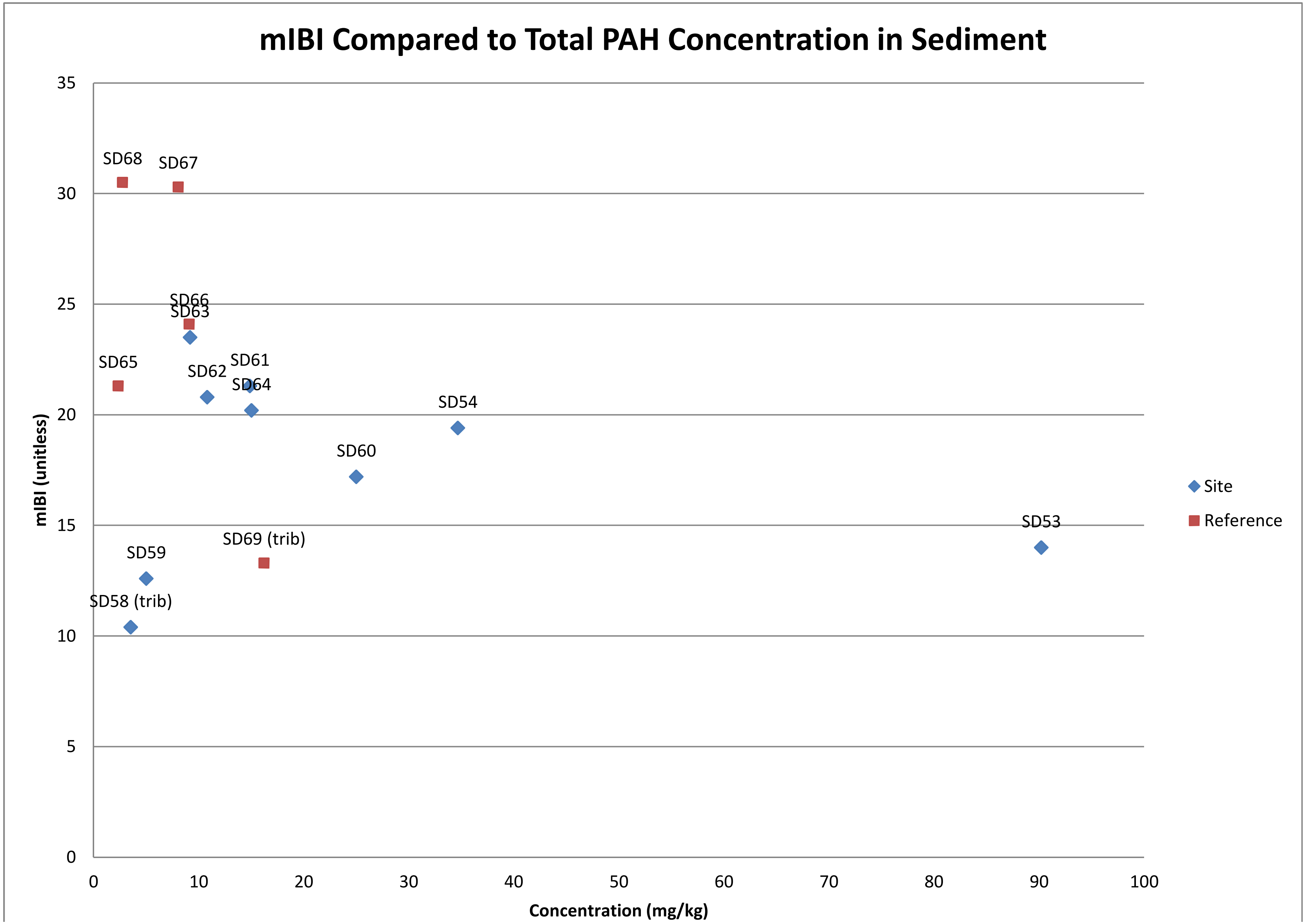

mIBI Compared to Copper Concentration in Sediment
mIBI (unitless)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
10
20
30
40
50
60
70
80
90
100
SD68
SD67
SD66
SD63
SD65
SD61
SD62
SD64
SD54
SD60
SD53
SD69 (trib)
SD59
SD58 (trib)
Site
Reference



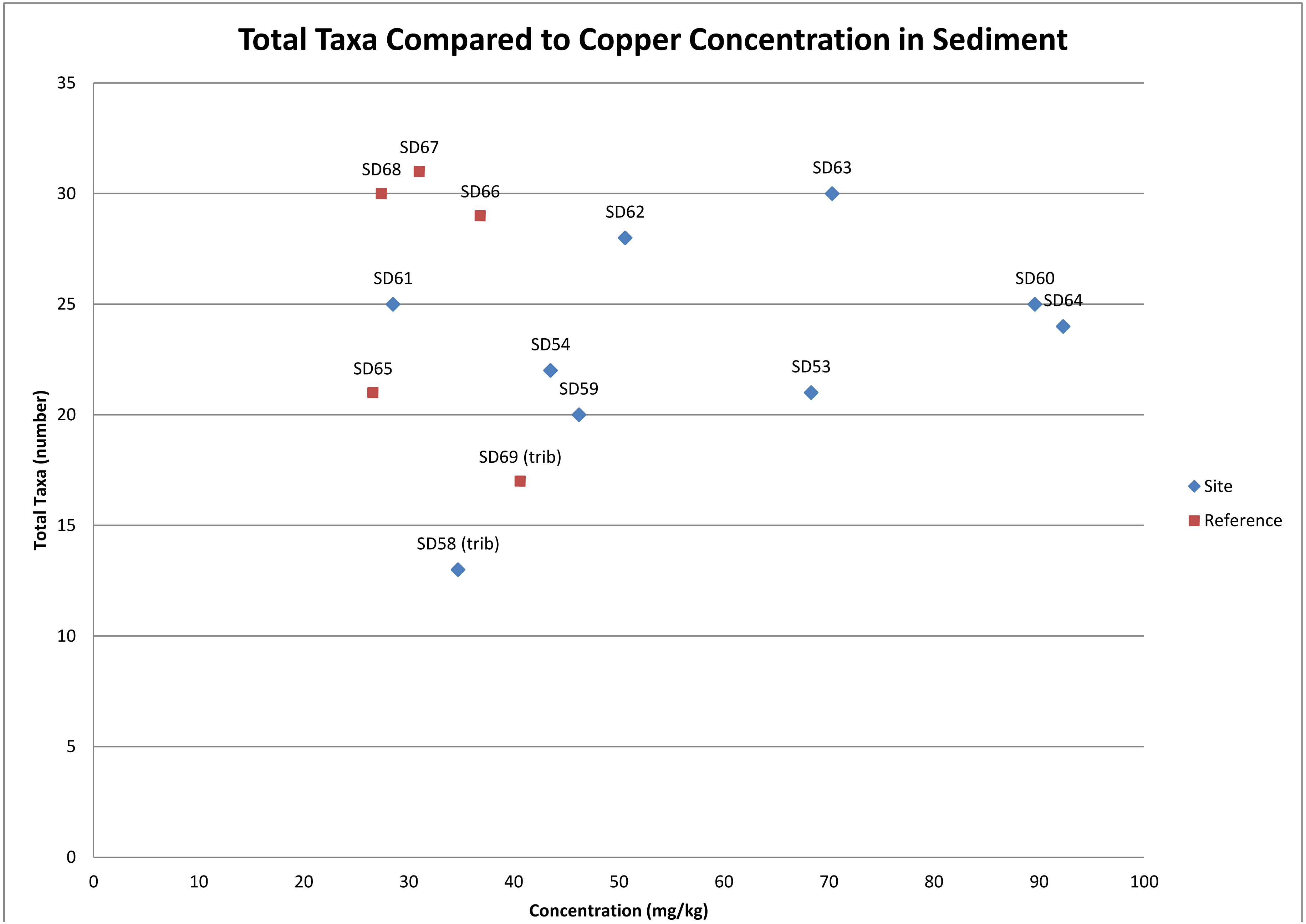
mIBI Compared to Lead Concentration in Sediment
mIBI (unitless)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
SD68
SD67
SD66
SD63
SD61
SD65
SD62
SD54
SD64
SD60
SD53
SD69 (trib)
SD59
SD58 (trib)
Site
Reference



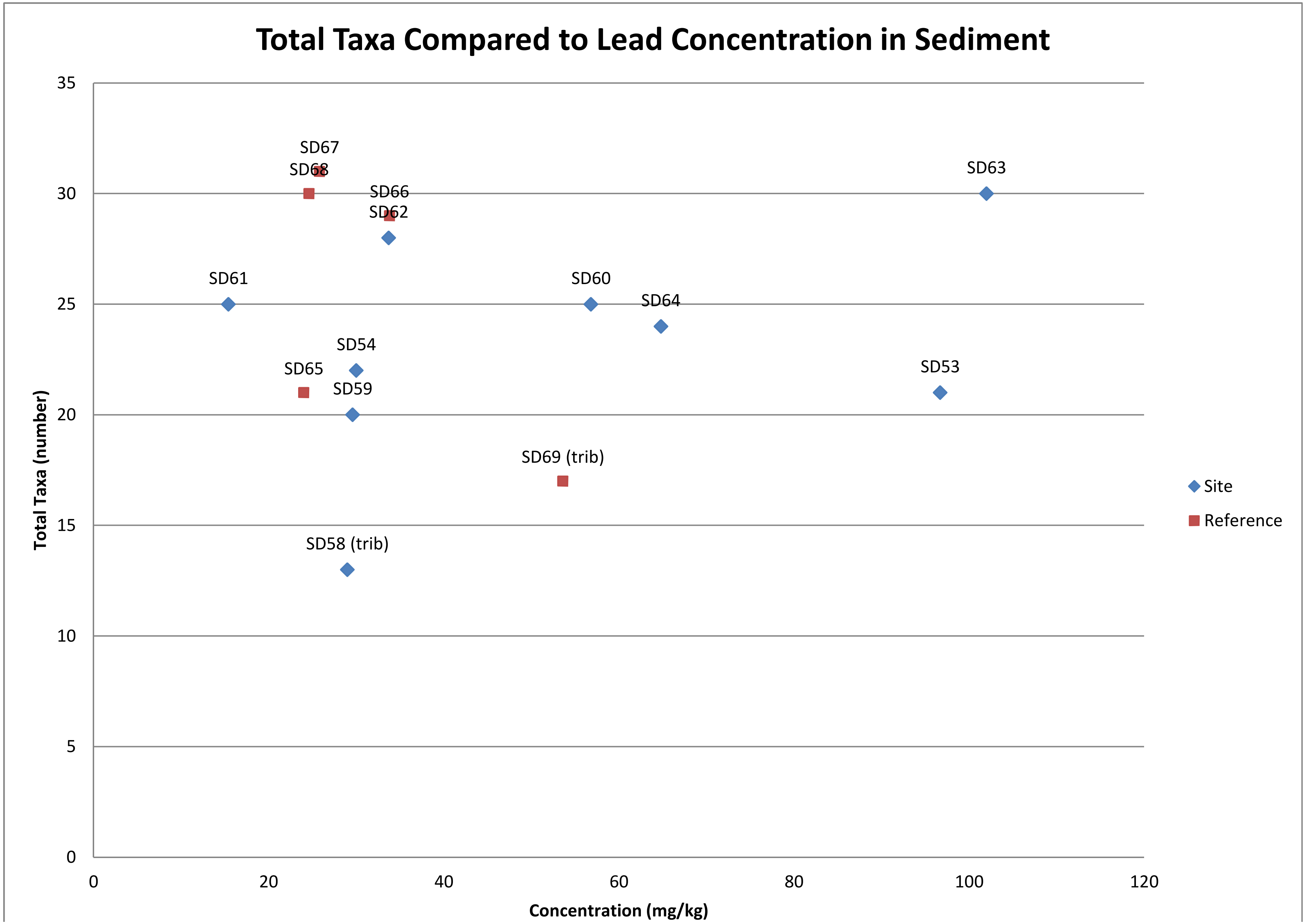
mIBI Compared to Zinc Concentration in Sediment
mIBI (unitless)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350
400
450
SD68
SD67
SD66
SD63
SD62
SD61
SD65
SD54
SD64
SD60
SD53
SD69 (trib)
SD59
SD58 (trib)
Site
Reference



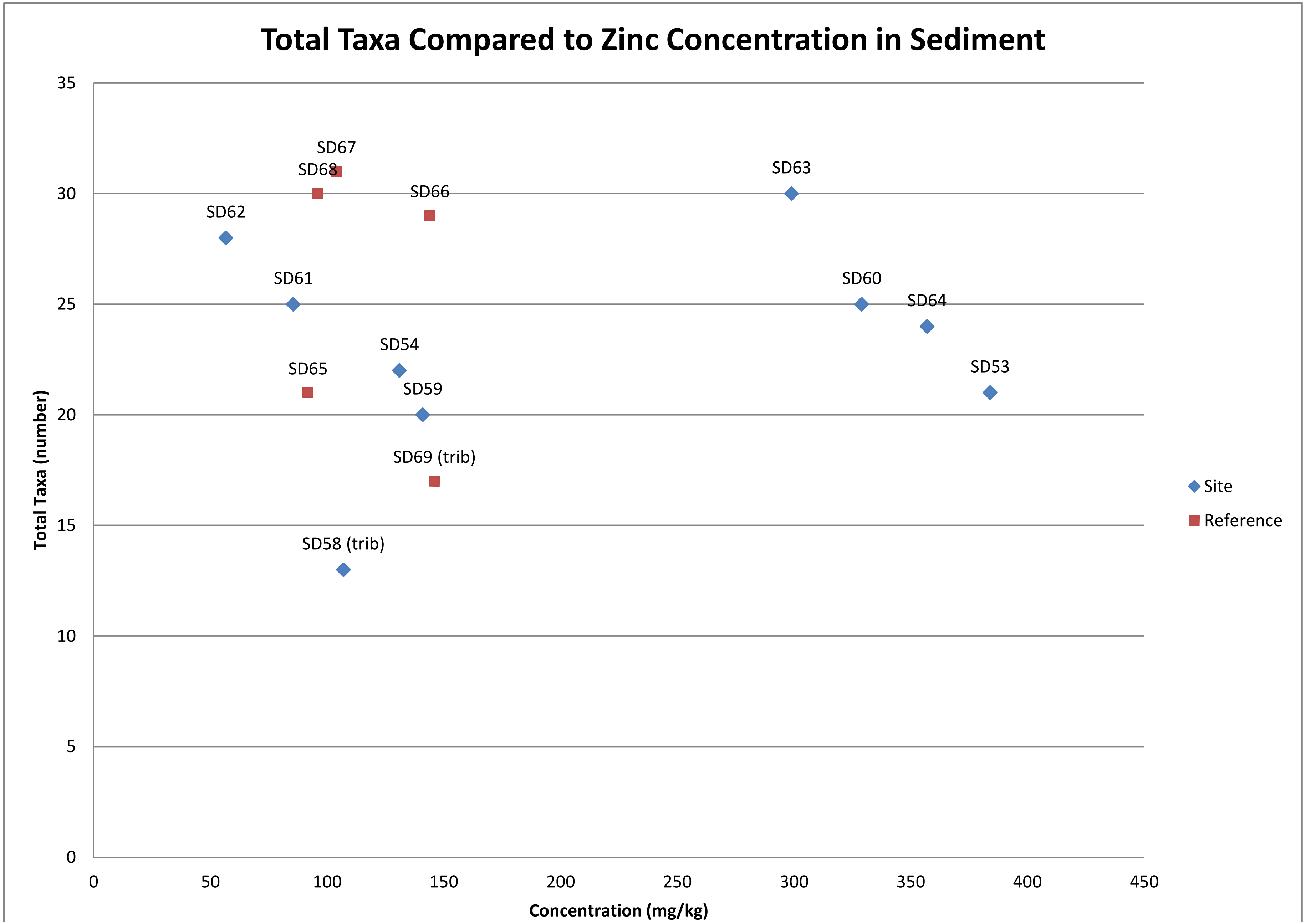
mIBI Compared to Total PAH Concentration in Sediment
mIBI (unitless)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
10
20
30
40
50
60
70
80
90
100
SD68
SD67
SD66
SD63
SD65
SD62
SD61
SD64
SD54
SD60
SD53
SD59
SD69 (trib)
SD58 (trib)
Site
Reference



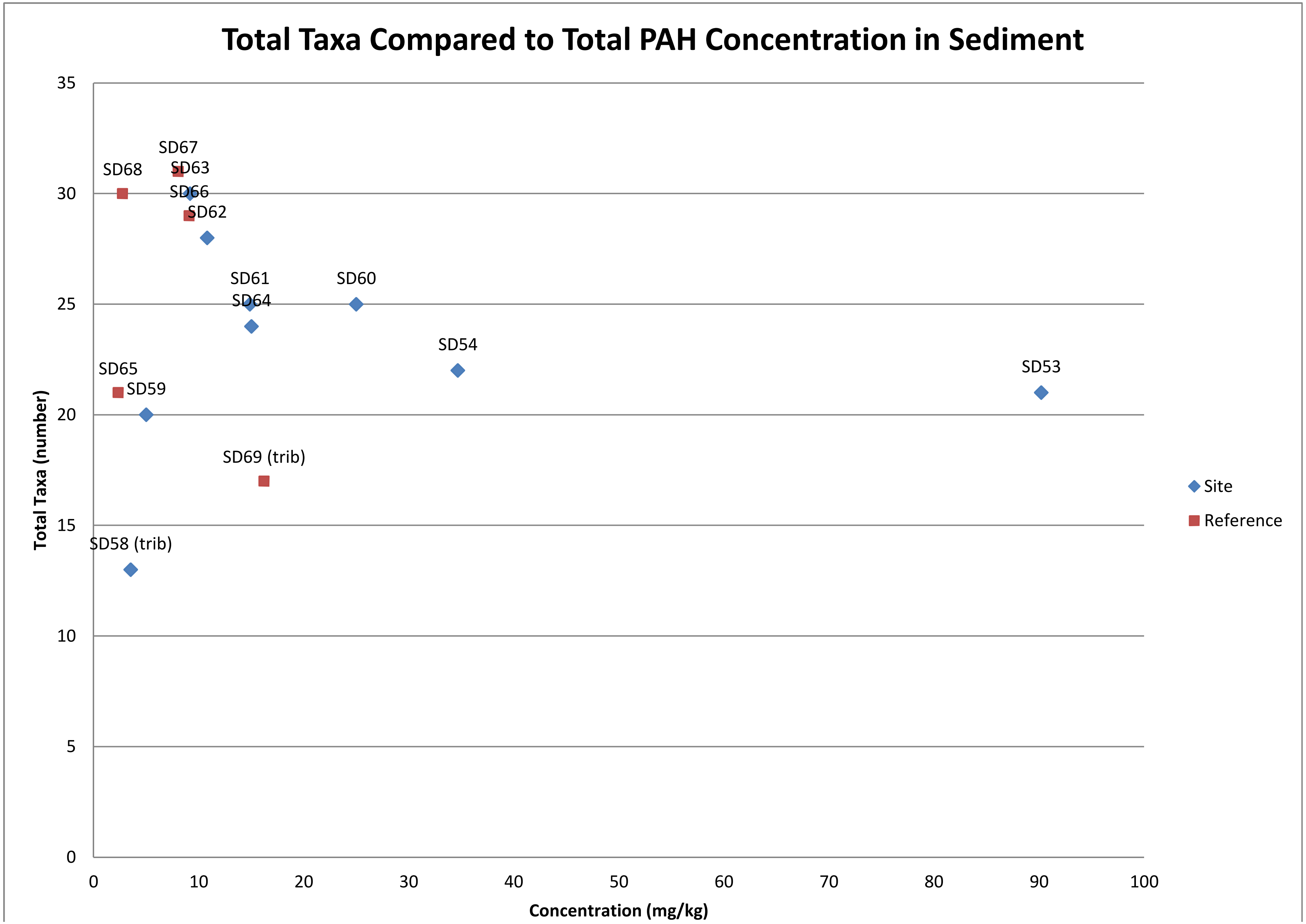
Total Taxa Compared to Copper Concentration in Sediment
Total Taxa (number)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
10
20
30
40
50
60
70
80
90
100
SD67
SD68
SD66
SD63
SD62
SD61
SD60
SD64
SD54
SD65
SD53
SD59
SD69 (trib)
SD58 (trib)
Site
Reference



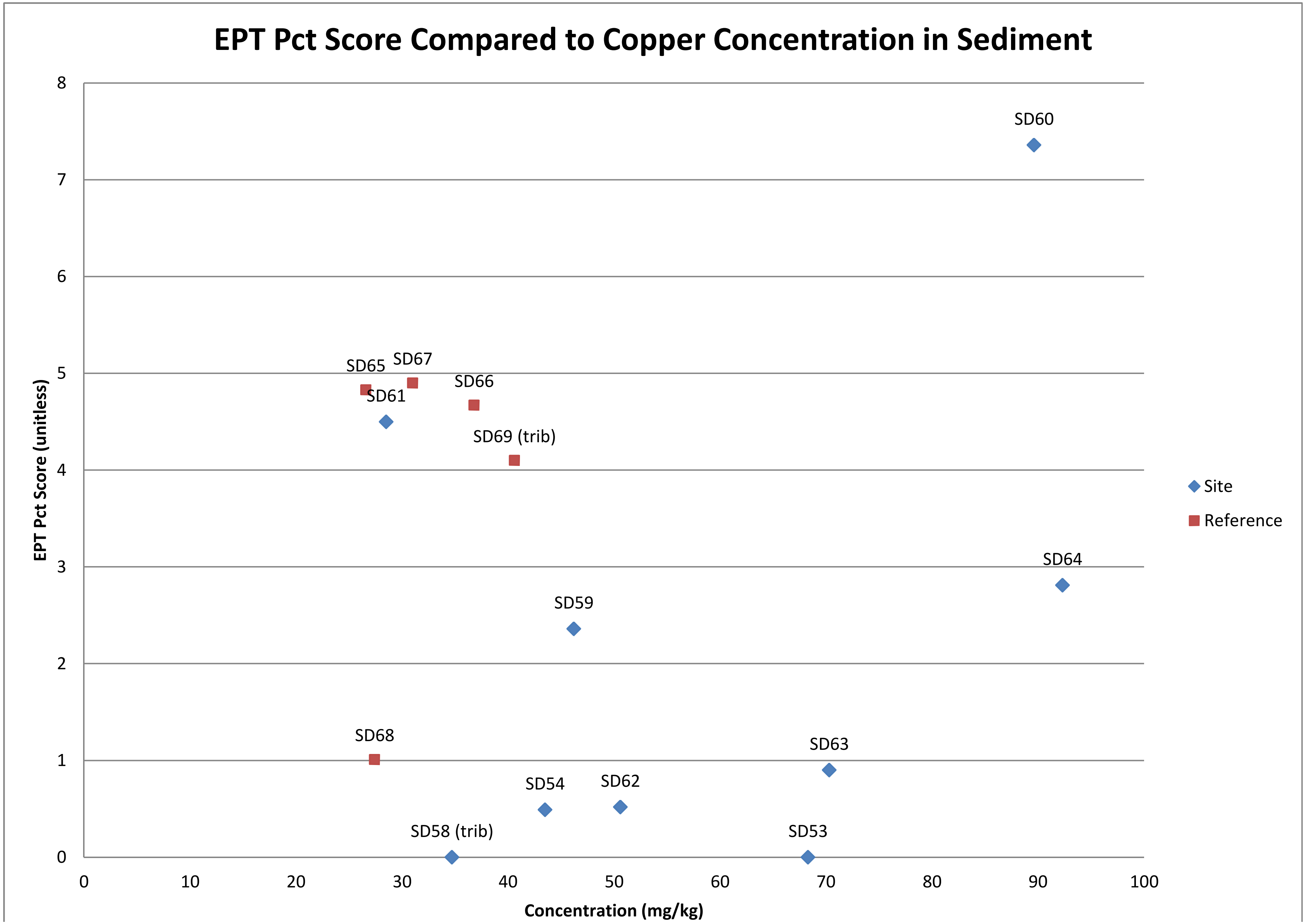
Total Taxa Compared to Lead Concentration in Sediment
Total Taxa (number)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
SD67
SD68
SD66
SD62
SD63
SD61
SD60
SD64
SD54
SD65
SD59
SD53
SD69 (trib)
SD58 (trib)
Site
Reference



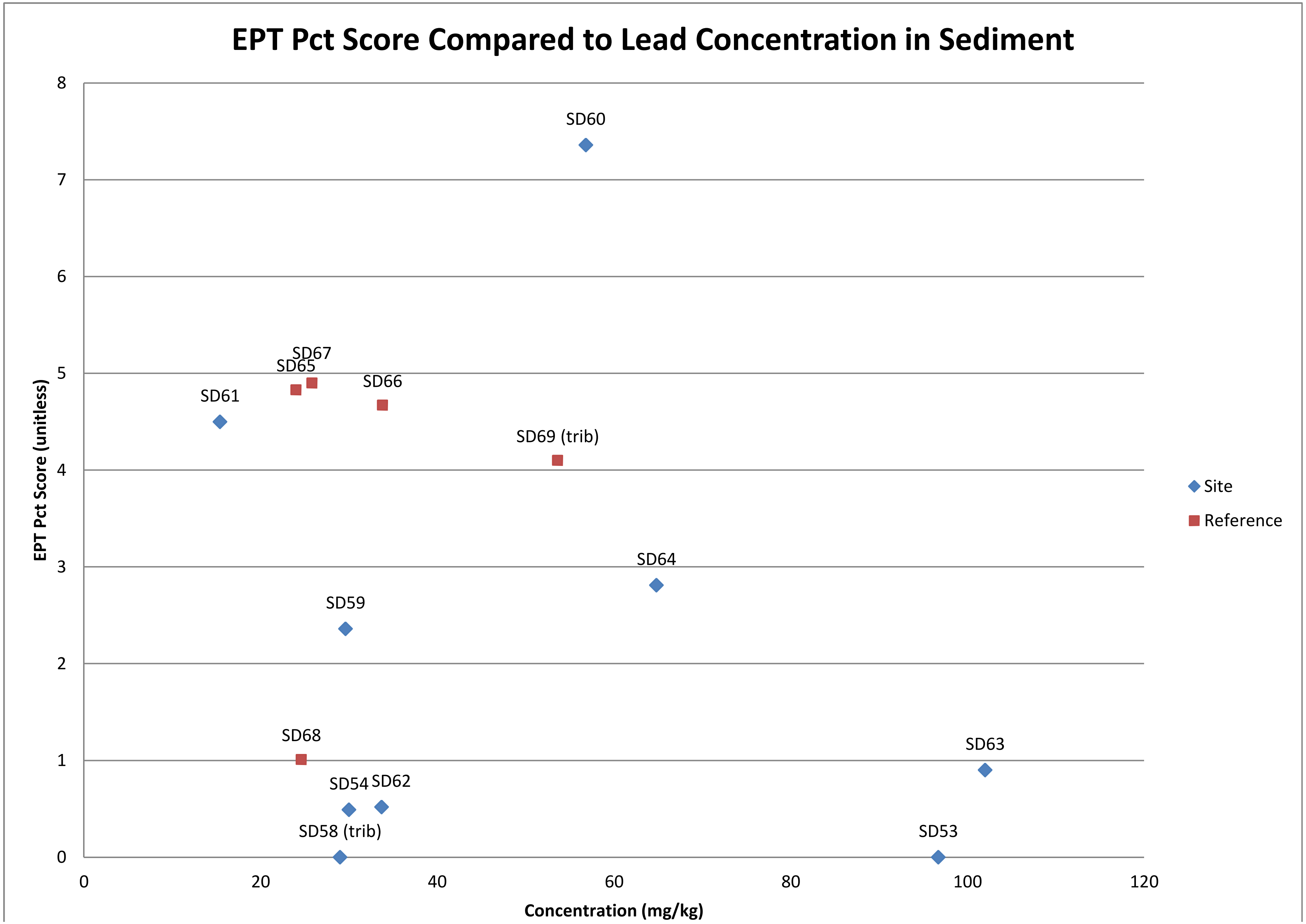
Total Taxa Compared to Zinc Concentration in Sediment
Total Taxa (number)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350
400
450
SD67
SD68
SD66
SD63
SD62
SD61
SD60
SD64
SD54
SD65
SD59
SD53
SD69 (trib)
SD58 (trib)
Site
Reference

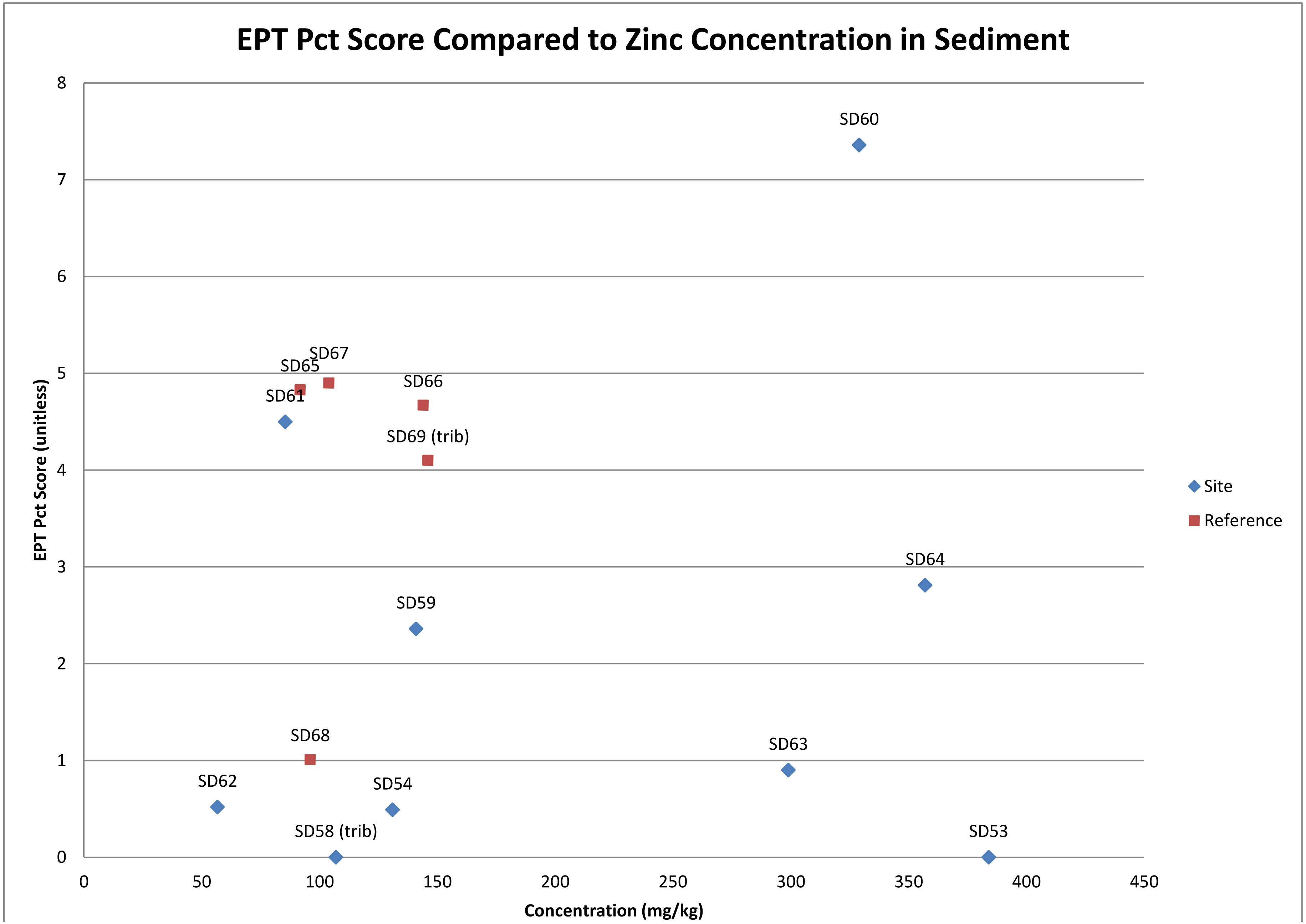


Total Taxa Compared to Total PAH Concentration in Sediment
Total Taxa (number)
Concentration (mg/kg)
0
5
10
15
20
25
30
35
0
10
20
30
40
50
60
70
80
90
100
SD67
SD68
SD63
SD66
SD62
SD61
SD60
SD64
SD54
SD53
SD65
SD59
SD69 (trib)
SD58 (trib)
Site
Reference

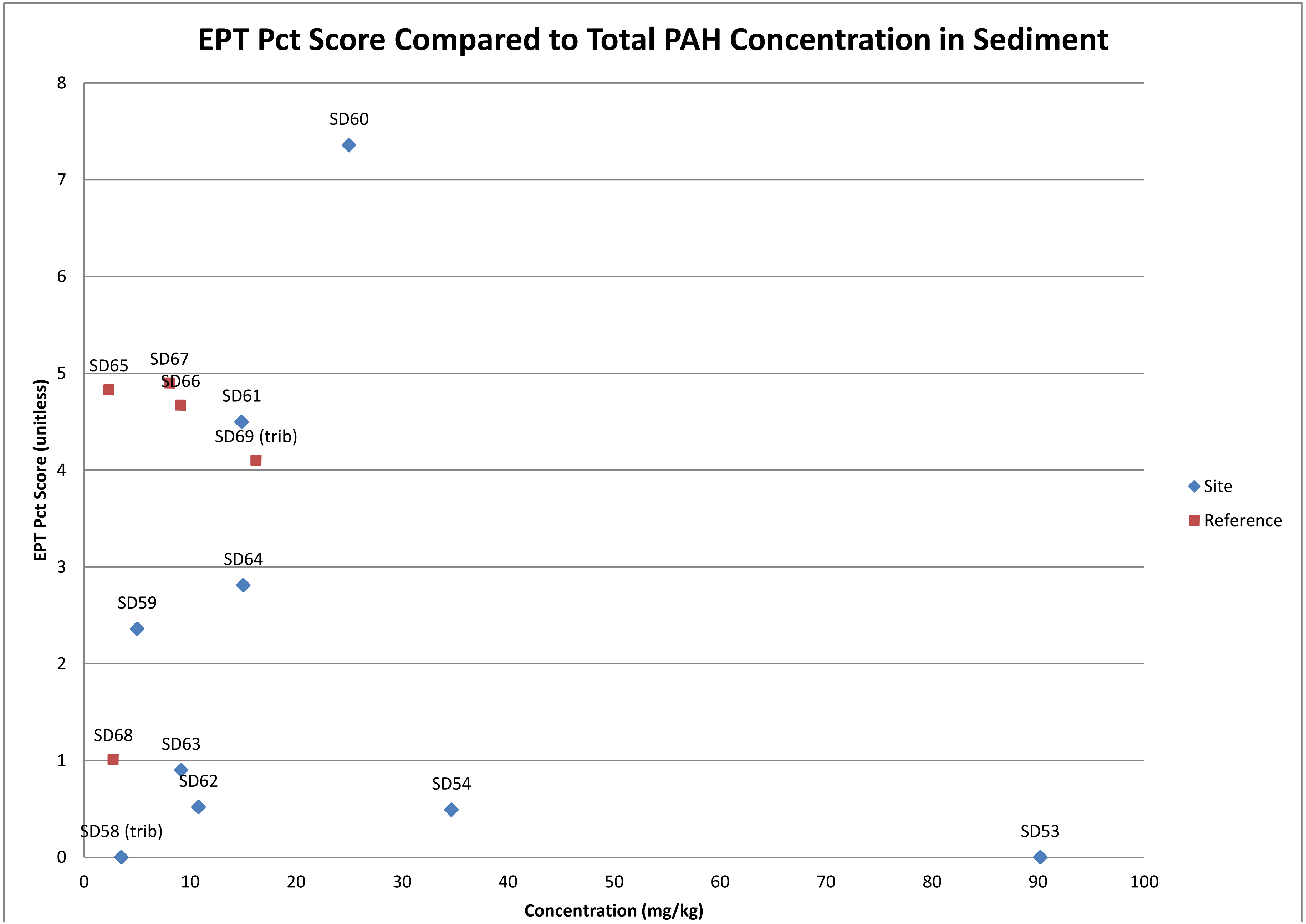


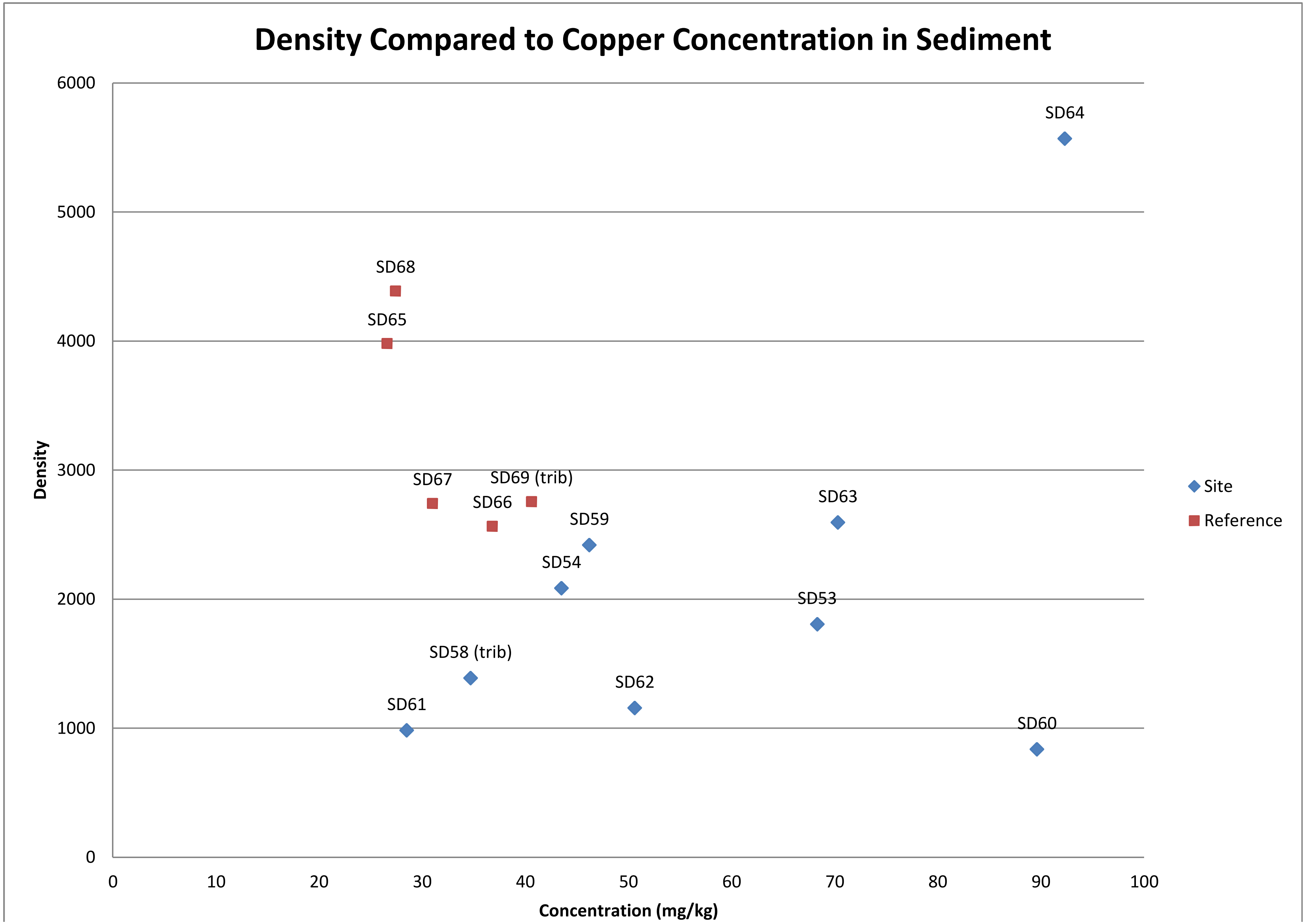
EPT Pct Score Compared to Copper Concentration in Sediment
EPT Pct Score (unitless)
Concentration (mg/kg)
0
1
2
3
4
5
6
7
8
0
10
20
30
40
50
60
70
80
90
100
SD60
SD65
SD67
SD66
SD61
SD69 (trib)
SD64
SD59
SD68
SD63
SD54
SD62
SD58 (trib)
SD53
Site
Reference

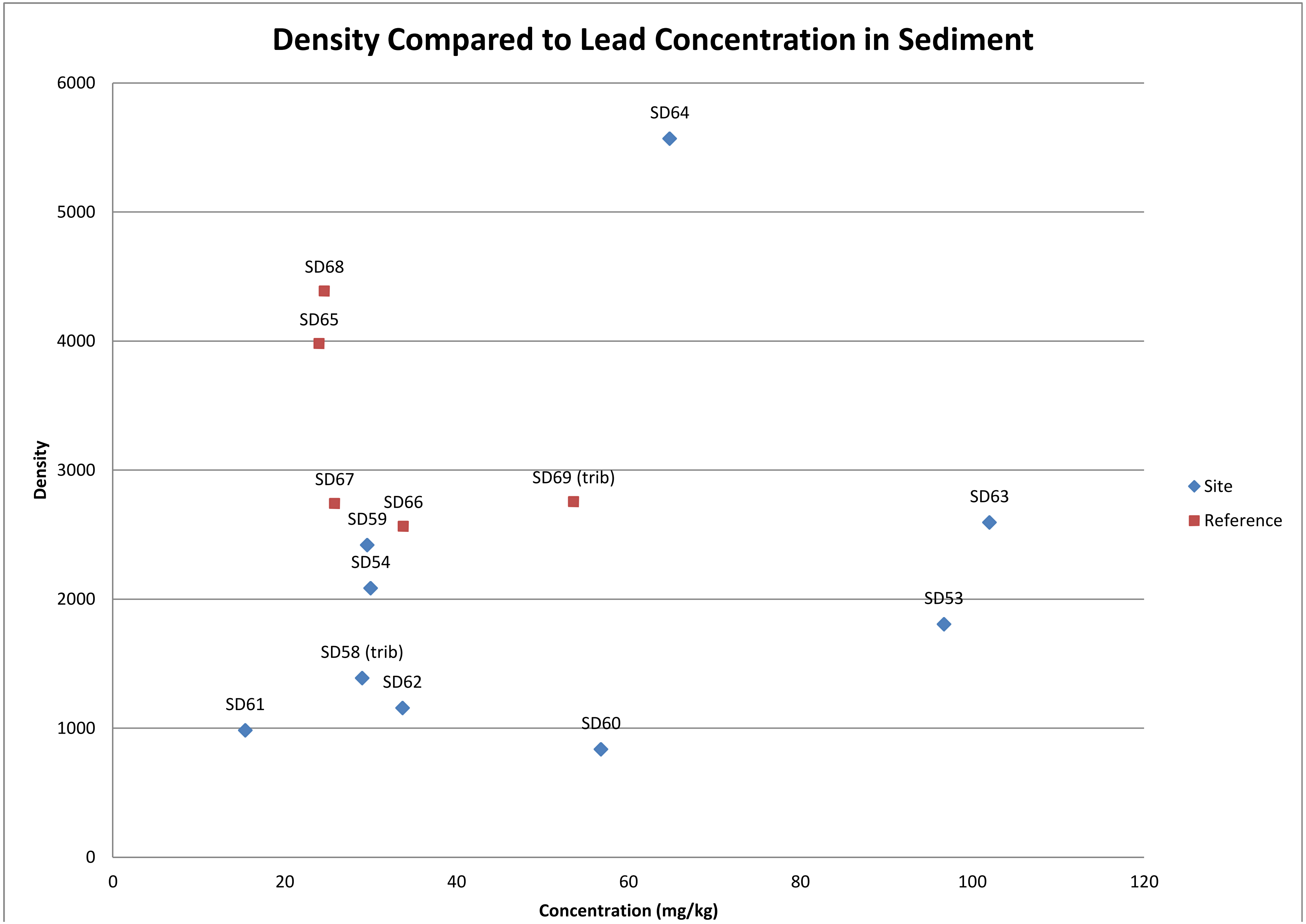

EPT Pct Score Compared to Lead Concentration in Sediment
EPT Pct Score (unitless)
Concentration (mg/kg)
0
1
2
3
4
5
6
7
8
0
20
40
60
80
100
120
SD60
SD67
SD65
SD66
SD61
SD69 (trib)
SD64
SD59
SD68
SD63
SD54
SD62
SD58 (trib)
SD53
Site
Reference

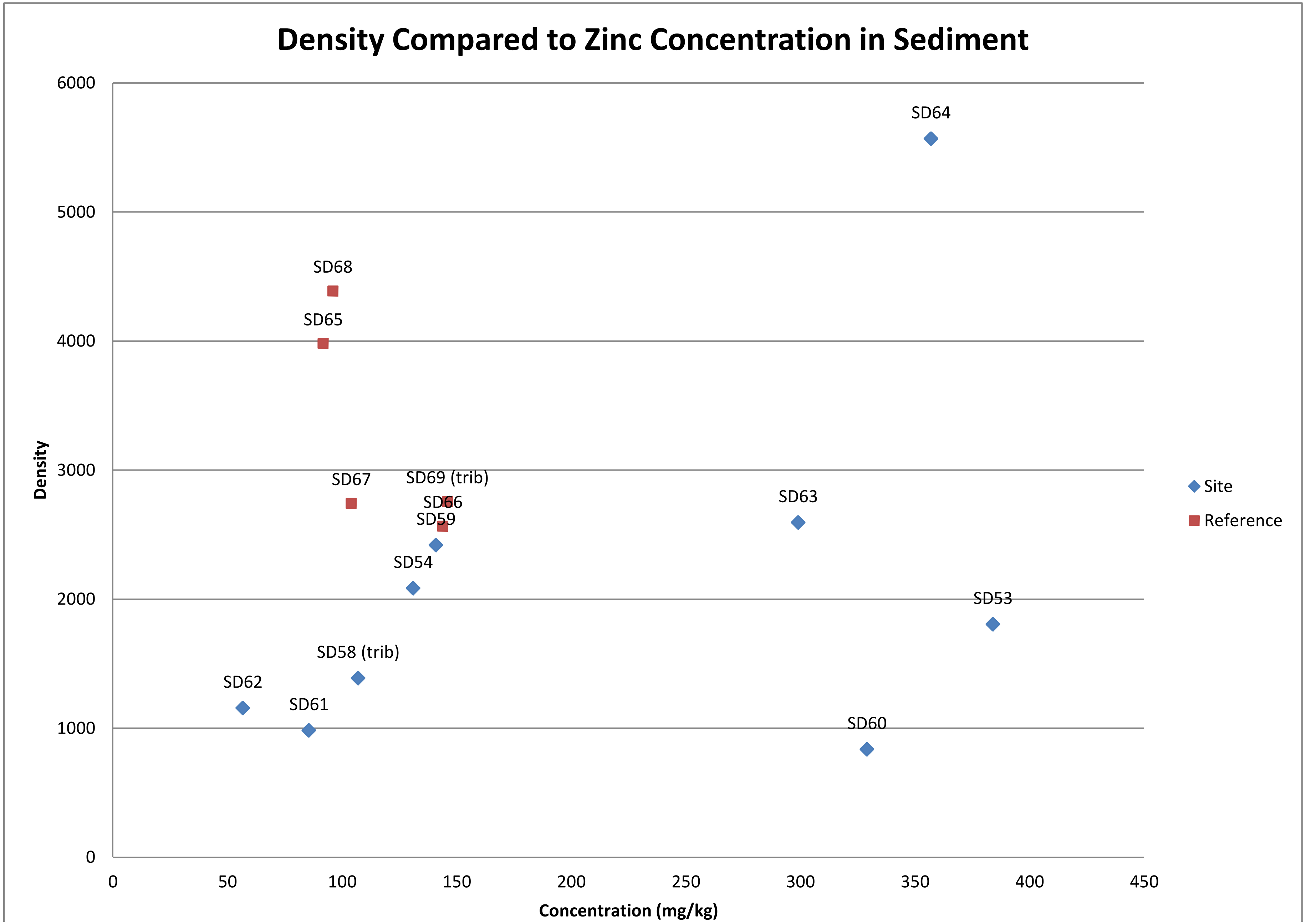


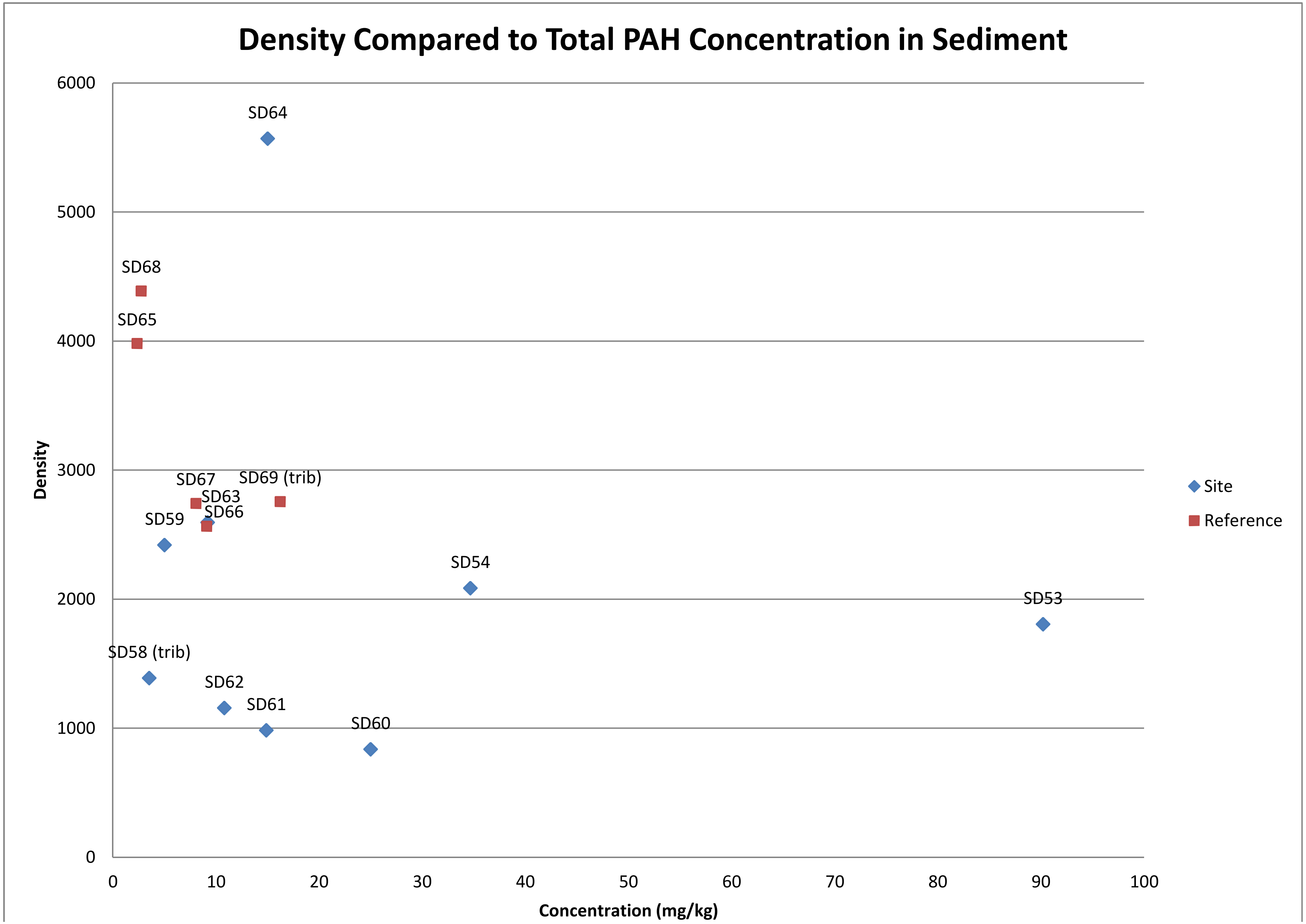
EPT Pct Score Compared to Zinc Concentration in Sediment
EPT Pct Score (unitless)
Concentration (mg/kg)
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
300
350
400
450
SD60
SD67
SD65
SD61
SD66
SD69 (trib)
SD64
SD59
SD68
SD63
SD62
SD54
SD58 (trib)
SD53
Site
Reference


EPT Pct Score Compared to Total PAH Concentration in Sediment
EPT Pct Score (unitless)
Concentration (mg/kg)
0
1
2
3
4
5
6
7
8
0
10
20
30
40
50
60
70
80
90
100
SD60
SD65
SD67
SD66
SD61
SD69 (trib)
SD64
SD59
SD68
SD63
SD62
SD54
SD58 (trib)
SD53
Site
Reference


Density Compared to Copper Concentration in Sediment
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
Density
Concentration (mg/kg)
SD64
SD68
SD65
SD67
SD69 (trib)
SD66
SD59
SD54
SD63
SD53
SD58 (trib)
SD62
SD61
SD60
Site
Reference


Density Compared to Lead Concentration in Sediment
Density
Concentration (mg/kg)
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
120
SD64
SD68
SD65
SD67
SD69 (trib)
SD66
SD59
SD54
SD63
SD53
SD58 (trib)
SD62
SD61
SD60
Site
Reference


Density Compared to Zinc Concentration in Sediment
Density
Concentration (mg/kg)
0
1000
2000
3000
4000
5000
6000
0
50
100
150
200
250
300
350
400
450
SD64
SD68
SD65
SD67
SD69 (trib)
SD66
SD59
SD54
SD63
SD53
SD58 (trib)
SD62
SD61
SD60
Site
Reference


Density Compared to Total PAH Concentration in Sediment
Density
Concentration (mg/kg)
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
SD64
SD68
SD65
SD67
SD63
SD66
SD69 (trib)
SD59
SD54
SD53
SD58 (trib)
SD62
SD61
SD60
Site
Reference

APPENDIX C

DATA VALIDATION REPORTS AND DATA USABILITY ASSESSMENT

DATA VALIDATION REPORTS

Tetra Tech INC

INTERNAL CORRESPONDENCE

TO:	**B. DAVIS**	**DATE:**	**MAY 7, 2012**
FROM:	**JOSEPH KALINYAK**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION – PAH / PEST / PCB**
NTC GREAT LAKES, CTO 474
SAMPLE DELIVERY GROUP (SDG) – 1204004

SAMPLES: 1 / Aqueous / PAH / PEST / PCB

RB033012-01

22 / Sediment / PAH / PEST / PCB

FD032812-01	FD032812-02	NTC17PCSD53
NTC17PCSD54	NTC17PCSD55	NTC17PCSD56
NTC17PCSD57	NTC17PCSD58	NTC17PCSD59
NTC17PCSD60	NTC17PCSD61	NTC17PCSD62
NTC17PCSD63	NTC17PCSD64	NTC17PCSD65
NTC17PCSD66	NTC17PCSD67	NTC17PCSD68
NTC17PCSD69	NTC17PCSD70	NTC17PCSD71
NTC17PCSD72		

Overview

The sample set for NTC Great Lakes, CTO 474, SDG 1204004 consisted of twenty-two (22) sediment samples and one (1) aqueous rinse blank sample. The samples were analyzed for polynuclear aromatic hydrocarbons (PAH), pesticides (PEST), and polychlorinated biphenyls (PCB), as indicated above. Two (2) field duplicate sample pairs were included in the Sample Delivery Group (SDG); FD032812-01 / NTC17PCSD61 and FD032812-02 / NTC17PCSD53.

The samples were collected by TetraTech on March 27, 28, 29, and 30, 2012 and analyzed by Empirical Laboratories, LLC. All analyses were conducted using USEPA SW-846 Method 8270D Selective Ion Monitoring (SIM) for PAHs, 8081 for PEST, and 8082A for PCBs, analytical and reporting protocols.

The data contained in this SDG were fully validated with regard to the following parameters for samples FD032812-01, FD032812-02, NTC17PCSD61, NTC17PCSD53, NTC17PCSD70, and NTC17PCSD72:

* • Data Completeness
* • Holding Times
* • GC/MS Tuning
• Initial and Continuing Calibration
• Laboratory Blank Analyses
• Surrogate Recoveries
• Blank Spike/Blank Spike Duplicate Results
* • Internal Standard Recoveries
• Field Duplicate Precision

- * Compound Quantitation
- * Compound Identification
- * Detection Limits

The remainder of the SDG samples were validated with regard to the following parameters:

- * Data Completeness
- * Holding Times
- * GC/MS Tuning
- Initial and Continuing Calibration
- Laboratory Blank Analyses
- Field Duplicate Precision
- * Compound Identification

The symbol (*) indicates that quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A. Results as reported by the laboratory are presented in Appendix B.

PAH

The following PAH contaminants were detected in the method blank for batch 2D04004 at the following maximum concentrations for the laboratory contaminants.

Analyte	Maximum Conc. µg/L	Action Level µg/L
Benzo(a)anthracene (1)	0.0526	0.2630
Chrysene (1)	0.0516	0.2580
Fluoranthene (1)	0.0697	0.3485

(1) Method Blank for batch 2D04004 affecting rinse blank sample RB033012-01.

An action level of five times the maximum level for laboratory contaminants has been used to evaluate sample data for blank contamination. Sample aliquot and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. Rinse blank samples are not qualified for method blank contamination.

The PAH analyte MS and MSD %Rs and the MS/MSD RPDs were non-compliant for the sample NTC17PCSD61 as listed below. Additionally, other PAH analytes were non-compliant but were not evaluated for validation purposes as the native sample PAH analyte concentrations were >5X the spike concentration. The positive PAH results for the sample NTC17PCSD61 were qualified estimated, (J), as listed in the "ACTION" column.

Analytes	MS %R	MSD %R	RPD	ACTION
Acenaphthene	-126	-85.1	44.1	J
Dibenzo(a,h)anthracene	-141	-51.2	44.6	J
Fluorene	-198	-151	43.1	J
2-Methylnaphthalene	20.3	21.1	----	J
Naphthalene	16.0	16.6	----	J

The PAH analyte MS and MSD %Rs and the MS/MSD RPDs were non-compliant for the sample FD032812-02 as listed below. Additionally, other PAH analytes were non-compliant but were not evaluated for validation purposes as the native sample PAH analyte concentrations were >5X the spike concentration. The positive dibenzo(a,h)anthracene result for the sample FD032812-02 was qualified estimated, (J), as listed in the "ACTION" column. The 2-methylnapthalene and naphthalene sample results were non-detected and were not qualified.

Analytes	MS %R	MSD %R	RPD	ACTION
Dibenzo(a,h)anthracene	145	----	----	J
2-Methylnaphthalene	117	----	39.4	----
Naphthalene	110	----	----	----

The relative percent differences (RPDs) were greater than the 50% quality control limit for acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene for field duplicate samples FD032812-01 and NTC17PCSD61. The positive and non-detected sample results were qualified estimated, (J) and (UJ), for field duplicate imprecision.

The RPDs were greater than the 50% quality control limit for 2-methylnaphthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene for field duplicate samples FD032812-02 and NTC17PCSD753. The positive and non-detected sample results were qualified estimated, (J) and (UJ), for field duplicate imprecision.

PEST

The pesticide analyte list in the Sample Analysis Plan (SAP) was incorrect/incomplete. Twenty-one pesticide compounds were analyzed and reported by the laboratory.

The following PEST contaminant was detected in the method blank for at the following maximum concentrations for the laboratory contaminants.

Analyte	Maximum Conc.	Action Level
gamma-Chlordane (1)	0.00171 mg/kg	0.00855 mg/kg
gamma-Chlordane (2)	0.0166 µg/L	0.0830 µg/L

(1) Method Blank for batch 2D05007 affecting samples NTC17PCSD53, NTC17PCSD58, NTC17PCSD65, NTC17PCSD66, NTC17PCSD67, NTC17PCSD68, and NTC17PCSD69.

(2) Method blank for batch 2D03005 affecting sample RB033012-01.

An action level of five times the maximum level for laboratory contaminants has been used to evaluate sample data for blank contamination. Sample aliquot, percent solids, and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. Rinse blank samples are not qualified for method blank contamination.

The continuing calibration verification (CCV) percent difference (%D) was greater than the 20% quality control limit for instrument GL-ECD3 for analytes and for times listed below.

Column	Analytes
ZB MR-1 on 04/10/12 @ 08:12	heptachlor
ZB MR-2 on 04/10/12 @ 08:12	4,4'-DDE, 4,4'-DDD, dieldrin, toxaphene (@ 09:09)
ZB MR-1 on 04/10/12 @ 15:07	4,4'-DDD, 4,4'-DDT, methoxychlor, toxaphene(@ 15:26)
ZB MR-2 on 04/10/12 @ 15:07	4,4'-DDE, 4,4'-DDT, aldrin, alpha-BHC, alpha-chlordane, beta-BHC, delta-BHC, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, gamma-BHC, gamma-chlordane, heptachlor, heptachlor epoxide, methoxychlor, toxaphene(@ 15:26)

Affected samples:

NTC17PCSD54	NTC17PCSD55	NTC17PCSD56
NTC17PCSD57	NTC17PCSD60	NTC17PCSD61
NTC17PCSD62	NTC17PCSD63	NTC17PCSD64

Action: With the exception of heptachlor, methoxychlor, and toxaphene, the non-detected PEST results for the samples were not qualified as the alternate column was compliant. The non-detected heptachlor, methoxychlor, and toxaphene sample results were qualified estimated, (UJ). The positive 4,4'-DDD and 4,4'-DDT sample results were qualified estimated, (J). The remaining aforementioned positive analyte results were not qualified as they were reported from the compliant analytical column with the exceptions listed below.

Specific sample actions:

NTC17PCSD55 – ZB MR-2 - positive alpha-chlordane, delta-BHC, endosulfan II, gamma-chlordane, and methoxychlor results qualified estimated, (J).
NTC17PCSD56 – ZB MR-2 - positive gamma-chlordane result qualified estimated, (J).
NTC17PCSD57 – ZB MR-2 - positive gamma-chlordane result qualified estimated, (J).
NTC17PCSD62 – ZB MR-2 – positive delta-BHC, endosulfan II, and gamma-chlordane results qualified estimated, (J).
NTC17PCSD64 – ZB MR-2 - positive gamma-chlordane result qualified estimated, (J).

The CCV %D was greater than the 20% quality control limit for instrument GL-ECD3 for analytes and for times listed below.

Column	Analytes
ZB MR-2 on 04/11/12 @ 10:34	toxaphene
ZB MR-2 on 04/11/12 @ 13:45	delta-BHC, endosulfan sulfate, toxaphene(@ 14:04)

Affected sample: RB033012-01

Action: No validation action as all sample results were non-detected and the alternate column was compliant.

The CCV %D was greater than the 20% quality control limit for instrument GL-ECD3 for analytes and for times listed below.

Column	Analytes
ZB MR-2 on 04/11/12 @ 13:45	delta-BHC, endosulfan sulfate, toxaphene(@ 14:04)
ZB MR-1 on 04/11/12 @ 20:02	4,4'-DDD, 4,4'-DDT, endrin ketone, heptachlor, methoxychlor, toxaphene(@ 20:21)
ZB MR-2 on 04/11/12 @ 20:02	4,4'-DDE, 4,4'-DDT, aldrin, alpha-BHC, alpha-chlordane, beta-BHC, delta-BHC, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, gamma-BHC, gamma-chlordane, heptachlor, heptachlor epoxide, methoxychlor,

toxaphene(@ 20:21)

Affected samples:

FD032812-01	FD032812-02	NTC17PCSD53
NTC17PCSD58	NTC17PCSD59	NTC17PCSD65
NTC17PCSD66	NTC17PCSD70	NTC17PCSD71
NTC17PCSD72		

Action: With the exception of 4,4'-DDT, endrin ketone, heptachlor, methoxychlor, and toxaphene, the non-detected PEST results for the samples were not qualified as the alternate column was compliant. The non-detected 4,4'-DDT, endrin ketone, heptachlor, methoxychlor, and toxaphene sample results were qualified estimated, (UJ). The positive 4,4'-DDD, 4,4'-DDT, and methoxychlor sample results were qualified estimated, (J). The remaining aforementioned positive analyte results were not qualified as they were reported from the compliant analytical column with the exceptions listed below.

Specific sample actions:

FD032812-02 – ZB MR-2 - positive alpha-BHC results qualified estimated, (J).
NTC17PCSD53 – ZB MR-2 - positive alpha-BHC and endosulfan II results qualified estimated, (J).
NTC17PCSD58 – ZB MR-2 - positive endosulfan II result qualified estimated, (J).
NTC17PCSD59 – ZB MR-2 – positive alpha-BHC and gamma-chlordane results qualified estimated, (J).
NTC17PCSD65 – ZB MR-2 - positive delta-BHC result qualified estimated, (J).
NTC17PCSD66 – ZB MR-2 - positive alpha- BHC and delta-BHC results qualified estimated, (J).
NTC17PCSD71 – ZB MR-2 - positive 4,4'-DDE and aldrin results qualified estimated, (J).
NTC17PCSD72 – ZB MR-2 - positive 4,4'-DDE, alpha-BHC, endrin, and gamma-BHC results qualified estimated, (J).

The CCV %D was greater than the 20% quality control limit for instrument GL-ECD3 for analytes and for times listed below.

Column	Analytes
ZB MR-2 on 04/12/12 @ 09:55	aldrin, alpha-BHC, beta-BHC, delta-BHC, endosulfan II, endosulfan sulfate, endrin aldehyde, endrin ketone, gamma-BHC, methoxychlor
ZB MR-1 on 04/12/12 @ 11:48	4,4'-DDD, 4,4'-DDT, methoxychlor, toxaphene(@ 12:07)
ZB MR-2 on 04/12/12 @ 11:48	4,4'-DDE, 4,4'-DDT, aldrin, alpha-BHC, alpha-chlordane, beta-BHC, delta-BHC, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, gamma-BHC, gamma-chlordane, heptachlor, heptachlor epoxide, methoxychlor, toxaphene(@ 12:07)

Affected samples:

NTC17PCSD67	NTC17PCSD68	NTC17PCSD69

Action: With the exception of methoxychlor and toxaphene, the non-detected PEST results for the samples were not qualified as the alternate column was compliant. The non-detected methoxychlor and toxaphene sample results were qualified estimated, (UJ). The positive 4,4'-DDT, and methoxychlor sample results were qualified estimated, (J). The remaining aforementioned positive analyte results were not qualified as they were reported from the compliant analytical column with the exceptions listed below.

Specific sample actions:

NTC17PCSD67 – ZB MR-1 - positive 4,4'-DDD result qualified estimated, (J).
NTC17PCSD67 – ZB MR-2 - positive aldrin, delta-BHC, and endrin results qualified estimated, (J).
NTC17PCSD68 – ZB MR-1 - positive 4,4'-DDD result qualified estimated, (J).
NTC17PCSD68 – ZB MR-2 - positive aldrin, delta-BHC, and endrin results qualified estimated, (J).

NTC17PCSD69 – ZB MR-1 - positive 4,4'-DDD result qualified estimated, (J).
NTC17PCSD69 – ZB MR-2 - positive delta-BHC and endosulfan II results qualified estimated, (J).

The LCS %R result for 4,4'-DDE was greater than the quality control limit for the ZB MR-1 column affecting samples in the batch 2D05007.

Affected sample: NTC17PCSD53
Action: The positive 4,4'-DDE results for the aforementioned sample was qualified estimated, (J), as the sample results were reported from the ZB MR-1 column.

The LCS %R results were greater than the quality control limit affecting samples in the batch 2D02015 for analytical columns as listed below.

Both columns %R analyte: 4,4'-DDE
ZB MR-1 column: heptachlor
ZB MR-2 column: alpha-chlordane, dieldrin, endrin ketone, and gamma-chlordane
Affected samples:

FD032812-01	FD032812-02	NTC17PCSD54
NTC17PCSD55	NTC17PCSD56	NTC17PCSD57
NTC17PCSD59	NTC17PCSD60	NTC17PCSD61
NTC17PCSD62	NTC17PCSD63	NTC17PCSD64
NTC17PCSD70	NTC17PCSD71	NTC17PCSD72

Action: The non-detected aforementioned sample analyte results were not qualified. The positive 4,4'-DDE results for the aforementioned samples were qualified estimated, (J). The remainder of the sample positive analyte results were not qualified as they were reported from the compliant analytical column.

The PEST analyte MS and MSD %Rs and the MS/MSD RPDs were quality control limit non-compliant for the analytical columns affecting sample NTC17PCSD53 as listed below. The positive and non-detected sample analytes were qualified estimated, (J) and (UJ), respectively. The analyte qualification is listed in the "ACTION" column based on which column the analyte result was reported from for positive results and non-compliances on both columns with %Rs less than the quality control limit for non-detected results.

	ZB MR-1			ZB MR-2			
Analytes	**MS %R**	**MSD%R**	**RPD**	**MS %R**	**MSD %R**	**RPD**	**ACTION**
4,4'-DDE	275	126	45.3	----	47.1	45.4	J
4,4'-DDD	150	----	----	----	----	----	J
4,4'-DDT	152	----	55.7	----	24.6	49.0	J
Aldrin	----	----	32.9	----	30.4	42.5	UJ
alpha-BHC	----	----	----	54.3	36.5	38.5	J
alpha-Chlordane	----	----	----	47.3	35.0	30.5	----
beta-BHC	----	49.3	----	42.7	33.9	----	UJ
delta-BHC	----	----	----	41.6	31.8	----	----
Dieldrin	----	----	----	52.0	40.5	----	----
Ensosulfan I	----	----	----	----	----	36.5	----
Endosulfan II	----	----	----	----	----	----	----
Endosulfan sulfate	----	----	----	43.8	35.7	----	----
Endrin	----	----	----	47.9	33.0	34.8	----
Endrin aldehyde	----	----	----	33.7	27.8	----	----
Endrin ketone	----	----	----	42.1	30.7	31.7	----
gamma-BHC	----	----	----	48.4	35.3	32.0	----
gamma-Chlordane	----	----	----	47.7	35.7	----	----
Heptachlor	----	----	30.4	48.2	34.4	34.2	UJ
Heptachlor epoxide	----	----	----	49.9	36.5	31.9	----
Methoxychlor	----	----	----	36.5	24.7	35.9	----

The PEST analyte MS and MSD %Rs and the MS/MSD RPDs were quality control limit non-compliant for the analytical columns affecting sample NTC17PCSD61 as listed below. The positive and non-detected sample analytes were qualified estimated, (J) and (UJ), respectively. The analyte qualification is listed in the "ACTION" column based on which column the analyte result was reported from for positive results and non-compliances on both columns with %Rs less than the quality control limit for non-detected results.

	B MR-1			ZB MR-2			
Analytes	**MS %R**	**MSD%R**	**RPD**	**MS %R**	**MSD %R**	**RPD**	**ACTION**
4,4'-DDE	----	----	----	50.7	59.0	----	----
4,4'-DDD	----	168	----	----	----	----	J
4,4'-DDT	30.1	----	86.2	15.5	44.9	81.8	J
Aldrin	----	----	----	----	----	----	----
alpha-BHC	----	----	----	55.2	52.0	----	----
alpha-Chlordane	----	----	----	52.1	48.6	----	----
beta-BHC	----	----	----	51.3	43.8	----	----
delta-BHC	----	----	----	----	46.0	----	----
Dieldrin	----	----	----	53.2	50.7	----	----
Ensosulfan I	----	----	----	----	----	----	----
Endosulfan II	----	----	----	----	----	----	----
Endosulfan sulfate	----	----	----	53.7	44.9	----	----
Endrin	----	----	----	50.2	47.7	----	----
Endrin aldehyde	----	----	----	----	----	----	----
Endrin ketone	----	----	----	46.6	39.0	----	----
gamma-BHC	----	----	----	53.7	50.6	----	----
gamma-Chlordane	----	----	----	55.4	52.3	----	----
Heptachlor	----	----	----	48.9	46.5	----	----
Heptachlor epoxide	----	----	----	56.0	52.4	----	----
Methoxychlor	45.6	46.4	----	27.5	26.6	----	UJ

The surrogate %Rs were quality control limit non-compliant for tetrachloro-m-xylene (TCX) and decachlorobiphenyl (DCB) for the analytical columns for the samples listed below. All surrogate %Rs were greater than 0%.

Affected samples	TCX	DCB	TCX (2)	DCB (2)
NTC17PCSD61	----	----	low	low
FD032812-01	----	----	low	----
NTC17PCSD53	----	----	low	low
FD032812-02	----	----	low	low
NTC17PCSD70	----	----	low	low
NTC17PCSD72	----	----	low	low

Action: No validation action was necessary for samples NTC17PCSD61 and FD032812-01, as the alternate column, ZB MR-1, was compliant for the surrogates and the samples had positive results were reported from that column for the samples. Sample non-detected analyte results were not qualified as the alternate column, ZB MR-1, was compliant for the surrogates. The remainder of the sample positive results were qualified estimated, (J), as listed below, due to being reported from the affected column, ZB MR-2.

Sample	Analytes
NTC17PCSD53	alpha-BHC, endosulfan II
FD032812-02	alpha-BHC
NTC17PCSD70	4,4'-DDD
NTC17PCSD72	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-BHC, endrin, gamma-BHC, methoxychlor

The positive PEST sample FD032812-01, FD032812-02, NTC17PCSD61, NTC17PCSD53, NTC17PCSD70, and NTC17PCSD72 analytes were qualified estimated, (J), for relative percent differences (RPD) greater than the 40% quality control limit for samples as listed below.

Sample	Analytes
FD032812-01	4,4'-DDD, 4,4'-DDE, 4,4'-DDT
FD032812-02	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-BHC, endrin, gamma-chlordane
NTC17PCSD53	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-BHC, endrin, methoxychlor
NTC17PCSD61	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endrin
NTC17PCSD70	4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan II, gamma-chlordane
NTC17PCSD72	4,4'-DDD, 4,4'-DDE, alpha-BHC, dieldrin, gamma-BHC, gamma-chlordane

The relative percent differences (RPD) were greater than the 50% quality control limit for 4,4,'-DDD, 4,4'-DDE, and 4,4'-DDT for field duplicate samples FD032812-01 and NTC17PCSD61. The positive sample results were qualified estimated, (J), for field duplicate imprecision.

The RPDs were greater than the 50% quality control limit for 4,4'-DDT, endrin, gamma-chlordane, and methoxychlor for field duplicate samples FD032812-02 and NTC17PCSD53. The positive and non-detected sample results were qualified estimated, (J) and (UJ), for field duplicate imprecision with the exception of the gamma-chlordane result for sample NTC17PCSD53 which was qualified for method blank contamination.

Per the laboratory narrative, the sample NTC17PCSD55 beta-BHC and gamma-BHC limit of quantitation (LOQ), limit of detection (LOD), and method detection limits (MDL) were raised due to interference. The sample NTC17PCSD55 beta-BHC and gamma-BHC non-detected results were qualified estimated, (J).

PCB

The average CCV %Ds were greater than the 20% quality control limit for instrument GL-ECD3 for Aroclor-1016 and Aroclor-1260 for column ZB MR-2 on 04/04/12 @ 22:54 and on 04/05/12 @ 04:33.

Affected sample: None, LCS only

Action: No validation action was necessary as no samples were affected.

The average CCV %Ds were greater than the 20% quality control limit for instrument GL-ECD3 for Aroclor-1016 and Aroclor-1260 for column ZB MR-2 on 04/10/12 @ 15:45.

Affected samples:

NTC17PCSD54	NTC17PCSD55	NTC17PCSD56
NTC17PCSD57	NTC17PCSD60	NTC17PCSD61
NTC17PCSD62	NTC17PCSD63	NTC17PCSD64

Action: The sample non-detected results for Aroclor-1016 and Aroclor-1260 were not qualified as the alternate column, column ZB MR-1, was compliant for Aroclor-1016 and Aroclor-1260 for opening and closing CCVs. The positive Aroclor-1260 result for sample NTC17PCSD56 was reported from the ZB MR-2 column and was qualified estimated, (J). The remainder of the sample positive Aroclor-1260 results were not qualified as the results were reported from the ZB MR-1 column.

The average CCV %Ds were greater than the 20% quality control limit for instrument GL-ECD3 for Aroclor-1016 and Aroclor-1260 for column ZB MR-2 on 04/11/12 @ 20:40.

Affected samples:

FD032812-01	FD032812-02	NTC17PCSD53
NTC17PCSD58	NTC17PCSD59	NTC17PCSD65
NTC17PCSD66	NTC17PCSD70	NTC17PCSD71
NTC17PCSD72		

Action: The sample non-detected results for Aroclor-1016 and Aroclor-1260 were not qualified as the alternate column, column ZB MR-1, was compliant for Aroclor-1016 and Aroclor-1260 for opening and closing CCVs. The positive Aroclor-1260 results were not qualified as the results were reported from the compliant ZB MR-1 column.

The average CCV %Ds were greater than the 20% quality control limit for instrument GL-ECD3 for Aroclor-1260 for column ZB MR-2 on 04/11/12 @ 20:40.

Affected samples: NTC17PCSD67, NTC17PCSD68, and NTC17PCSD69

Action: The sample non-detected results for Aroclor-1260 were not qualified as the alternate column, column ZB MR-1, was compliant for Aroclor-1260 for opening and closing CCVs.

The LCS %Rs were greater than the quality control limit for batch 2D02015 for Aroclor-1016 and Aroclor-1260 for batch 2D02015 for the ZB MR-1 column.

Affected samples:

FD032812-01	FD032812-02	NTC17PCSD54
NTC17PCSD55	NTC17PCSD56	NTC17PCSD57
NTC17PCSD59	NTC17PCSD60	NTC17PCSD61
NTC17PCSD62	NTC17PCSD63	NTC17PCSD64
NTC17PCSD70	NTC17PCSD71	NTC17PCSD72

Action: The sample non-detected results for Aroclor-1016 and Aroclor-1260 were not qualified. The positive Aroclor-1260 result for samples NTC17PCSD55, NTC17PCSD56, NTC17PCSD62, NTC17PCSD70 and NTC17PCSD72 were qualified estimated, (J).

The MSD %R was less than the quality control limit for Aroclor-1260 for spiked sample NTC17PCSD61 for the ZB MR-2 column.

Action: No validation action was taken as the alternate column was compliant and the sample had a non-detected Aroclor-1260 result.

The surrogate %Rs were quality control limit non-compliant for tetrachloro-m-xylene (TCX) and decachlorobiphenyl (DCB) for the analytical columns for the samples listed below. All surrogate %Rs were greater than 0%.

Affected samples	TCX	DCB	TCX (2)	DCB (2)
NTC17PCSD61	----	----	low	low
FD032812-01	----	----	low	----
NTC17PCSD53	----	----	low	low
FD032812-02	----	----	low	low
NTC17PCSD70	----	----	***low***	***low***
NTC17PCSD72	----	----	***low***	***low***

Action: No validation action was necessary for samples NTC17PCSD61, FD032812-01, NTC17PCSD53, and FD032812-02 as the alternate column, column ZB MR-1, was compliant for the surrogates and the samples had non-detected results for the samples. Sample NTC17PCSD70 and NTC17PCSD72 non-detected results were not qualified as the alternate column was compliant and the positive results were not qualified as they were also reported from the compliant column (bolded italics).

The positive Aroclor-1260 results for the analytical columns had relative percent differences (RPD) greater than the 40% quality control limit for samples NTC17PCSD70 and NTC17PCSD72. The sample positive Aroclor-1260 results were qualified estimated, (J).

Additional Comments

Positive results reported below the Limit of Quantitation (LOQ) but above the method detection limit (MDL) were qualified as estimated, (J).

Samples were diluted for PAHs as listed below. The dilutions resulted in elevated reported concentrations for non-detected PAH analytes.

Sample	Dilution	Sample	Dilution
FD032812-01	5X	FD032812-02	10X
NTC17PCSD53	10X	NTC17PCSD54	20X
NTC17PCSD55	10X	NTC17PCSD56	10X
NTC17PCSD57	5X	NTC17PCSD58	5X
NTC17PCSD59	10X	NTC17PCSD60	10X
NTC17PCSD61	5X	NTC17PCSD62	10X
NTC17PCSD63	10X	NTC17PCSD64	10X
NTC17PCSD65	5X	NTC17PCSD66	10X
NTC17PCSD67	10X	NTC17PCSD68	10X
NTC17PCSD69	10X	NTC17PCSD70	20X
NTC17PCSD71	20X	NTC17PCSD72	20X

Samples were diluted for PESTs and Aroclors as listed below. The dilutions resulted in elevated reported concentrations for non-detected PEST and Aroclor analytes.

Sample	Dilution
NTC17PCSD56	5X
NTC17PCSD63	5X

The higher of the two column positive PEST sample results were reported except when the RPD was greater than 100%, in which case the lower of the two column PEST results was reported.

PAH and PEST analyte non-detected results for some analytes for the SDG samples were greater than the Project Action Level (PAL) concentrations for these analytes.

Executive Summary

Laboratory Performance: PEST results were qualified for method blank contamination. PEST results were qualified for %D non-compliances. PAH, PCB, and PEST results were qualified for MS/MSD, LCS, and surrogate %R non-compliances. PAH, PCB, and PEST results were qualified for field duplicate imprecision.

Other Factors Affecting Data Quality: Positive results reported below the LOQ but above the MDL were qualified as estimated, (J).

The data for these analyses were reviewed with reference to the USEPA Functional Guidelines for Organic Data Validation (10/99) and Department of Defense (DoD) document entitled "Quality Systems Manual (QSM) for Environmental Laboratories" (April 2009).

Tetra Tech
Joseph Kalinyak
Chemist/Data Validator

Tetra Tech
Joseph A. Samchuck
Quality Assurance Officer

Attachments:
Appendix A – Qualified Analytical Results
Appendix B – Results as Reported by the Laboratory
Appendix C – Support Documentation

Appendix A

Qualified Analytical Results

Value Qualifier Key (Val Qual)

J – The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

UJ – The result is an estimated non-detected quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

U - Value is a non-detect as reported by the laboratory.

UR – Non-detected result is considered rejected, (UR), as a result of technical non-compliances.

DATA QUALIFICATION CODE (QUAL CODE)

Qualifier Codes:

A	=	Lab Blank Contamination
B	=	Field Blank Contamination
C	=	Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01	=	GC/MS Tuning Noncompliance
D	=	MS/MSD Recovery Noncompliance
E	=	LCS/LCSD Recovery Noncompliance
F	=	Lab Duplicate Imprecision
G	=	Field Duplicate Imprecision
H	=	Holding Time Exceedance
I	=	ICP Serial Dilution Noncompliance
J	=	ICP PDS Recovery Noncompliance; MSA's r < 0.995
K	=	ICP Interference - includes ICS % R Noncompliance
L	=	Instrument Calibration Range Exceedance
M	=	Sample Preservation Noncompliance
N	=	Internal Standard Noncompliance
N01	=	Internal Standard Recovery Noncompliance Dioxins
N02	=	Recovery Standard Noncompliance Dioxins
N03	=	Clean-up Standard Noncompliance Dioxins
O	=	Poor Instrument Performance (i.e., base-time drifting)
P	=	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q	=	Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R	=	Surrogates Recovery Noncompliance
S	=	Pesticide/PCB Resolution
T	=	% Breakdown Noncompliance for DDT and Endrin
U	=	RPD between columns/detectors >40% for positive results determined via GC/HPLC
V	=	Non-linear calibrations; correlation coefficient r < 0.995
W	=	EMPC result
X	=	Signal to noise response drop
Y	=	Percent solids <30%
Z	=	Uncertainty at 2 sigma deviation is less than sample activity
Z1	=	Tentatively Identified Compound considered presumptively present
Z2	=	Tentatively Identified Compound column bleed

PROJ_NO: 01021	NSAMPLE	RB033012-01
SDG: 1204004	LAB_ID	1204004-23
FRACTION: PAH	SAMP_DATE	3/30/2012
MEDIA: WATER	QC_TYPE	NM
	UNITS	UG/L
	PCT_SOLIDS	0.0
	DUP_OF	

PARAMETER	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE	0.0943	U	
ACENAPHTHENE	0.0943	U	
ACENAPHTHYLENE	0.0943	U	
ANTHRACENE	0.0943	U	
BENZO(A)ANTHRACENE	0.0475	J	P
BENZO(A)PYRENE	0.0943	U	
BENZO(B)FLUORANTHENE	0.0943	U	
BENZO(G,H,I)PERYLENE	0.0943	U	
BENZO(K)FLUORANTHENE	0.0943	U	
CHRYSENE	0.0943	U	
DIBENZO(A,H)ANTHRACENE	0.0943	U	
FLUORANTHENE	0.112	J	P
FLUORENE	0.0943	U	
INDENO(1,2,3-CD)PYRENE	0.0943	U	
NAPHTHALENE	0.208		
PHENANTHRENE	0.102	J	P
PYRENE	0.0813	J	P

PROJ_NO: 01021	NSAMPLE	FD032812-01			FD032812-02			NTC17PCSD53			NTC17PCSD54		
SDG: 1204004	LAB_ID	1204004-09			1204004-15			1204004-16			1204004-14		
FRACTION: PAH	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/28/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.9			73.0			68.6			71.2		
	DUP_OF	NTC17PCSD61			NTC17PCSD53								
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE		0.0215	U		0.0453	UJ	G	0.212	J	G	0.0929	U	
ACENAPHTHENE		0.0215	UJ	G	0.0933	J	G	1.41	J	G	0.388		
ACENAPHTHYLENE		0.0215	U		0.0453	U		0.0482	U		0.0929	U	
ANTHRACENE		0.0688	J	G	0.334	J	G	2.43	J	G	1.34		
BENZO(A)ANTHRACENE		0.216	J	G	1.16	J	G	6.38	J	G	2.09		
BENZO(A)PYRENE		0.258	J	G	1.32	J	G	5.69	J	G	2.44		
BENZO(B)FLUORANTHENE		0.261	J	G	1.46	J	G	5.76	J	G	2.31		
BENZO(G,H,I)PERYLENE		0.176	J	G	0.828	J	G	2.82	J	G	1.55		
BENZO(K)FLUORANTHENE		0.272	J	G	1.34	J	G	6.15	J	G	2.68		
CHRYSENE		0.292	J	G	1.57	J	G	7.07	J	G	2.47		
DIBENZO(A,H)ANTHRACENE		0.0215	UJ	G	0.267	J	DG	0.933	J	G	0.595		
FLUORANTHENE		0.673	J	G	3.7	J	G	18.4	J	G	6.75		
FLUORENE		0.0215	UJ	G	0.109	J	G	1.44	J	G	0.535		
INDENO(1,2,3-CD)PYRENE		0.176	J	G	0.778	J	G	3.13	J	G	1.44		
NAPHTHALENE		0.0215	U		0.0453	UJ	G	0.473	J	G	0.0929	U	
PHENANTHRENE		0.364	J	G	1.93	J	G	13.4	J	G	4.96		
PYRENE		0.513	J	G	2.91	J	G	14.5	J	G	5.12		

PROJ_NO: 01021	NSAMPLE	NTC17PCSD55			NTC17PCSD56			NTC17PCSD57			NTC17PCSD58		
SDG: 1204004	LAB_ID	1204004-01			1204004-02			1204004-03			1204004-17		
FRACTION: PAH	SAMP_DATE	3/27/2012			3/27/2012			3/27/2012			3/29/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	82.3			77.2			80.3			77.8		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE		0.0389	U		0.0426	U		0.0206	U		0.0214	U	
ACENAPHTHENE		0.118			0.078	J	P	0.0206	U		0.0215	J	P
ACENAPHTHYLENE		0.0389	U		0.0426	U		0.0206	U		0.0214	U	
ANTHRACENE		0.306			0.26			0.0527			0.0567		
BENZO(A)ANTHRACENE		1.36			1.07			0.196			0.231		
BENZO(A)PYRENE		1.72			1.29			0.238			0.248		
BENZO(B)FLUORANTHENE		2.09			1.5			0.258			0.275		
BENZO(G,H,I)PERYLENE		1.24			1.05			0.188			0.168		
BENZO(K)FLUORANTHENE		1.71			1.3			0.25			0.289		
CHRYSENE		1.93			1.56			0.269			0.332		
DIBENZO(A,H)ANTHRACENE		0.419			0.34			0.046			0.0424	J	P
FLUORANTHENE		4.38			3.6			0.619			0.74		
FLUORENE		0.126			0.0905			0.0206	U		0.0214	U	
INDENO(1,2,3-CD)PYRENE		1.1			1.01			0.146			0.156		
NAPHTHALENE		0.0389	U		0.0426	U		0.0206	U		0.0214	U	
PHENANTHRENE		1.96			1.66			0.291			0.398		
PYRENE		3.36			2.73			0.486			0.578		

PROJ_NO: 01021	NSAMPLE	NTC17PCSD59			NTC17PCSD60			NTC17PCSD61			NTC17PCSD62		
SDG: 1204004	LAB_ID	1204004-13			1204004-08			1204004-07			1204004-06		
FRACTION: PAH	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/27/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	72.1			60.6			75.2			73.7		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE		0.0447	U		0.055	U		0.0408	J	DP	0.0443	U	
ACENAPHTHENE		0.0447	U		0.112			0.165	J	DG	0.0613	J	P
ACENAPHTHYLENE		0.0447	U		0.055	U		0.0217	U		0.0443	U	
ANTHRACENE		0.0805	J	P	0.376			0.564	J	G	0.203		
BENZO(A)ANTHRACENE		0.296			1.48			0.955	J	G	0.708		
BENZO(A)PYRENE		0.397			1.85			0.933	J	G	0.846		
BENZO(B)FLUORANTHENE		0.424			2.15			0.943	J	G	0.876		
BENZO(G,H,I)PERYLENE		0.322			1.31			0.609	J	G	0.594		
BENZO(K)FLUORANTHENE		0.455			2.09			0.919	J	G	0.831		
CHRYSENE		0.44			2.17			1.04	J	G	0.842		
DIBENZO(A,H)ANTHRACENE		0.105			0.508			0.252	J	DG	0.179		
FLUORANTHENE		0.977			5.14			3.02	J	G	2.27		
FLUORENE		0.0447	U		0.159			0.237	J	DG	0.0443	U	
INDENO(1,2,3-CD)PYRENE		0.31			1.3			0.568	J	G	0.553		
NAPHTHALENE		0.0447	U		0.0712	J	P	0.0306	J	DP	0.0443	U	
PHENANTHRENE		0.465			2.32			2.39	J	G	1.08		
PYRENE		0.746			3.97			2.22	J	G	1.77		

PROJ_NO: 01021 SDG: 1204004 FRACTION: PAH MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD63			NTC17PCSD64			NTC17PCSD65			NTC17PCSD66		
	LAB_ID	1204004-04			1204004-05			1204004-18			1204004-19		
	SAMP_DATE	3/27/2012			3/27/2012			3/29/2012			3/29/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.7			68.0			62.2			66.0		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE		0.0428	U		0.049	U		0.0261	U		0.0485	U	
ACENAPHTHENE		0.0428	U		0.0724	J	P	0.0261	U		0.0622	J	P
ACENAPHTHYLENE		0.0428	U		0.049	U		0.0261	U		0.0485	U	
ANTHRACENE		0.135			0.26			0.0399	J	P	0.185		
BENZO(A)ANTHRACENE		0.586			0.961			0.158			0.684		
BENZO(A)PYRENE		0.705			1.13			0.17			0.576		
BENZO(B)FLUORANTHENE		0.809			1.25			0.201			0.683		
BENZO(G,H,I)PERYLENE		0.515			0.838			0.127			0.328		
BENZO(K)FLUORANTHENE		0.752			1.18			0.196			0.707		
CHRYSENE		0.757			1.33			0.254			0.902		
DIBENZO(A,H)ANTHRACENE		0.162			0.285			0.038	J	P	0.158		
FLUORANTHENE		1.9			3.04			0.475			1.96		
FLUORENE		0.0515	J	P	0.101			0.0261	U		0.0485	U	
INDENO(1,2,3-CD)PYRENE		0.457			0.786			0.107			0.325		
NAPHTHALENE		0.0428	U		0.049	U		0.0261	U		0.0485	U	
PHENANTHRENE		0.873			1.46			0.197			1.04		
PYRENE		1.48			2.33			0.386			1.49		

PROJ_NO: 01021	NSAMPLE	NTC17PCSD67			NTC17PCSD68			NTC17PCSD69			NTC17PCSD70		
SDG: 1204004	LAB_ID	1204004-21			1204004-22			1204004-20			1204004-10		
FRACTION: PAH	SAMP_DATE	3/29/2012			3/29/2012			3/29/2012			3/28/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	59.7			60.5			70.4			44.9		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE		0.054	U		0.0533	U		0.047	U		0.144	U	
ACENAPHTHENE		0.054	U		0.0533	U		0.0604	J	P	0.144	U	
ACENAPHTHYLENE		0.054	U		0.0533	U		0.047	U		0.144	U	
ANTHRACENE		0.181			0.0533	U		0.047	U		0.144	U	
BENZO(A)ANTHRACENE		0.752			0.208			0.99			0.758		
BENZO(A)PYRENE		0.625			0.218			1.16			1.2		
BENZO(B)FLUORANTHENE		0.653			0.267			1.32			1.62		
BENZO(G,H,I)PERYLENE		0.288			0.149			0.737			1.08		
BENZO(K)FLUORANTHENE		0.645			0.252			1.35			1.18		
CHRYSENE		0.734			0.292			1.68			1.18		
DIBENZO(A,H)ANTHRACENE		0.0922	J	P	0.0533	U		0.207			0.144	U	
FLUORANTHENE		1.86			0.564			3.46			2.16		
FLUORENE		0.054	U		0.0533	U		0.0872	J	P	0.144	U	
INDENO(1,2,3-CD)PYRENE		0.296			0.124			0.683			0.925		
NAPHTHALENE		0.054	U		0.0533	U		0.047	U		0.144	U	
PHENANTHRENE		0.528			0.23			1.67			0.813		
PYRENE		1.4			0.448			2.83			1.77		

PROJ_NO: 01021 SDG: 1204004 FRACTION: PAH MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD71			NTC17PCSD72		
	LAB_ID	1204004-11			1204004-12		
	SAMP_DATE	3/28/2012			3/28/2012		
	QC_TYPE	NM			NM		
	UNITS	MG/KG			MG/KG		
	PCT_SOLIDS	70.4			75.6		
	DUP_OF						
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE		0.0927	U		0.413		
ACENAPHTHENE		0.165	J	P	1.82		
ACENAPHTHYLENE		0.0927	U		0.0881	U	
ANTHRACENE		0.0927	U		2.61		
BENZO(A)ANTHRACENE		1.91			7.14		
BENZO(A)PYRENE		2.62			7.8		
BENZO(B)FLUORANTHENE		2.89			7.08		
BENZO(G,H,I)PERYLENE		2.1			4.63		
BENZO(K)FLUORANTHENE		2.94			8.56		
CHRYSENE		2.81			8.81		
DIBENZO(A,H)ANTHRACENE		0.689			1.91		
FLUORANTHENE		6.8			21.9		
FLUORENE		0.215			1.76		
INDENO(1,2,3-CD)PYRENE		1.9			4.53		
NAPHTHALENE		0.0927	U		1.6		
PHENANTHRENE		3.38			17.8		
PYRENE		5.3			17.2		

PROJ_NO: 01021	NSAMPLE	RB033012-01
SDG: 1204004	LAB_ID	1204004-23
FRACTION: PEST	SAMP_DATE	3/30/2012
MEDIA: WATER	QC_TYPE	NM
	UNITS	UG/L
	PCT_SOLIDS	0.0
	DUP_OF	

PARAMETER	RESULT	VQL	QLCD
4,4'-DDD	0.00943	U	
4,4'-DDE	0.00943	U	
4,4'-DDT	0.00943	U	
ALDRIN	0.00943	U	
ALPHA-BHC	0.00943	U	
ALPHA-CHLORDANE	0.00943	U	
BETA-BHC	0.00943	U	
DELTA-BHC	0.00943	U	
DIELDRIN	0.00943	U	
ENDOSULFAN I	0.00943	U	
ENDOSULFAN II	0.00943	U	
ENDOSULFAN SULFATE	0.00943	U	
ENDRIN	0.00943	U	
ENDRIN ALDEHYDE	0.00943	U	
ENDRIN KETONE	0.00943	U	
GAMMA-BHC (LINDANE)	0.00943	U	
GAMMA-CHLORDANE	0.00943	U	
HEPTACHLOR	0.00943	U	
HEPTACHLOR EPOXIDE	0.00943	U	
METHOXYCHLOR	0.00943	U	
TOXAPHENE	0.472	U	

PROJ_NO: 01021	NSAMPLE	FD032812-01			FD032812-02			NTC17PCSD53			NTC17PCSD54		
SDG: 1204004	LAB_ID	1204004-09			1204004-15			1204004-16			1204004-14		
FRACTION: PEST	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/28/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.9			73.0			68.6			71.2		
	DUP_OF	NTC17PCSD61			NTC17PCSD53								
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
4,4'-DDD		0.00288	J	CGU	0.0153	J	CU	0.0138	J	CDU	0.0197	J	C
4,4'-DDE		0.00998	J	EGU	0.0417	J	EU	0.0629	J	DEU	0.0491	J	E
4,4'-DDT		0.0188	J	CGU	0.00739	J	CGU	0.0311	J	CDGU	0.00814	J	C
ALDRIN		0.000413	U		0.000435	U		0.000481	UJ	D	0.000464	U	
ALPHA-BHC		0.000413	U		0.00095	J	CRU	0.0007	J	CDPRU	0.000464	U	
ALPHA-CHLORDANE		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
BETA-BHC		0.000413	U		0.000435	U		0.000481	UJ	D	0.000464	U	
DELTA-BHC		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
DIELDRIN		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
ENDOSULFAN I		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
ENDOSULFAN II		0.0006	J	P	0.00132			0.00187	J	CR	0.00111		
ENDOSULFAN SULFATE		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
ENDRIN		0.00105			0.0012	J	GU	0.00341	J	GU	0.00151		
ENDRIN ALDEHYDE		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
ENDRIN KETONE		0.000413	UJ	C	0.000435	UJ	C	0.000481	UJ	C	0.000464	U	
GAMMA-BHC (LINDANE)		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
GAMMA-CHLORDANE		0.000413	U		0.00217	J	GU	0.00567	U	A	0.00171		
HEPTACHLOR		0.000413	UJ	C	0.000435	UJ	C	0.000481	UJ	CD	0.000464	UJ	C
HEPTACHLOR EPOXIDE		0.000413	U		0.000435	U		0.000481	U		0.000464	U	
METHOXYCHLOR		0.000413	UJ	C	0.000435	UJ	CG	0.00246	J	CGU	0.000464	UJ	C
TOXAPHENE		0.0209	UJ	C	0.022	UJ	C	0.0243	UJ	C	0.0235	UJ	C

PROJ_NO: 01021	NSAMPLE	NTC17PCSD55			NTC17PCSD56			NTC17PCSD57			NTC17PCSD58		
SDG: 1204004	LAB_ID	1204004-01			1204004-02			1204004-03			1204004-17		
FRACTION: PEST	SAMP_DATE	3/27/2012			3/27/2012			3/27/2012			3/29/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	82.3			77.2			80.3			77.8		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
4,4'-DDD		0.025	J	C	0.236	J	C	0.00203	J	C	0.00249	J	C
4,4'-DDE		0.036	J	E	0.131	J	E	0.00411	J	E	0.00631		
4,4'-DDT		0.0342	J	C	0.0526	J	C	0.00063	J	CP	0.00073	J	CP
ALDRIN		0.000388	U		0.00211	U		0.000403	U		0.000408	U	
ALPHA-BHC		0.000388	U		0.00211	U		0.000403	U		0.000408	U	
ALPHA-CHLORDANE		0.00059	J	CP	0.00211	U		0.000403	U		0.00029	J	P
BETA-BHC		0.000941	UJ	Z	0.00211	U		0.000403	U		0.000408	U	
DELTA-BHC		0.0007	J	CP	0.00211	U		0.000403	U		0.000408	U	
DIELDRIN		0.00032	J	P	0.00211	U		0.000403	U		0.000408	U	
ENDOSULFAN I		0.000388	U		0.00211	U		0.000403	U		0.000408	U	
ENDOSULFAN II		0.00228	J	C	0.00333	J	P	0.0009			0.0004	J	CP
ENDOSULFAN SULFATE		0.00076	J	P	0.00211	U		0.000403	U		0.000408	U	
ENDRIN		0.00366			0.00511			0.000403	U		0.000408	U	
ENDRIN ALDEHYDE		0.000388	U		0.00211	U		0.000403	U		0.000408	U	
ENDRIN KETONE		0.000388	U		0.00211	U		0.000403	U		0.000408	UJ	C
GAMMA-BHC (LINDANE)		0.000823	UJ	Z	0.00211	U		0.00037	J	P	0.000408	U	
GAMMA-CHLORDANE		0.0006	J	CP	0.00666	J	C	0.00329	J	C	0.00315	U	A
HEPTACHLOR		0.000388	UJ	C	0.00211	UJ	C	0.000403	UJ	C	0.000408	UJ	C
HEPTACHLOR EPOXIDE		0.000388	U		0.00211	U		0.000403	U		0.000408	U	
METHOXYCHLOR		0.00418	J	C	0.00211	UJ	C	0.000403	UJ	C	0.000408	UJ	C
TOXAPHENE		0.0196	UJ	C	0.107	UJ	C	0.0204	UJ	C	0.0206	UJ	C

PROJ_NO: 01021 SDG: 1204004 FRACTION: PEST MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD59			NTC17PCSD60			NTC17PCSD61			NTC17PCSD62		
	LAB_ID	1204004-13			1204004-08			1204004-07			1204004-06		
	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/27/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	72.1			60.6			75.2			73.7		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
4,4'-DDD		0.00637	J	C	0.0218	J	C	0.00829	J	CDGU	0.0427	J	C
4,4'-DDE		0.0139	J	E	0.0259	J	E	0.0179	J	EGU	0.0366	J	E
4,4'-DDT		0.00559	J	C	0.0361	J	C	0.00456	J	CDGU	0.0432	J	C
ALDRIN		0.000449	U		0.000538	U		0.00043	U		0.00055	J	P
ALPHA-BHC		0.00022	J	CP	0.000538	U		0.00043	U		0.000448	U	
ALPHA-CHLORDANE		0.000449	U		0.000538	U		0.00043	U		0.000448	U	
BETA-BHC		0.000449	U		0.000538	U		0.00043	U		0.000448	U	
DELTA-BHC		0.000449	U		0.000538	U		0.00043	U		0.00021	J	CP
DIELDRIN		0.000449	U		0.000538	U		0.00043	U		0.000448	U	
ENDOSULFAN I		0.000449	U		0.000538	U		0.00043	U		0.000448	U	
ENDOSULFAN II		0.00027	J	P	0.00297			0.00046	J	P	0.00023	J	CP
ENDOSULFAN SULFATE		0.000449	U		0.000538	U		0.00043	U		0.000448	U	
ENDRIN		0.00053	J	P	0.00218			0.00099	J	U	0.00222		
ENDRIN ALDEHYDE		0.000449	U		0.000538	U		0.00043	U		0.000448	U	
ENDRIN KETONE		0.000449	UJ	C	0.000538	U		0.00043	U		0.000448	U	
GAMMA-BHC (LINDANE)		0.000449	U		0.00079	J	P	0.00043	U		0.000448	U	
GAMMA-CHLORDANE		0.00081	J	CP	0.00288			0.00068	J	P	0.00028	J	CP
HEPTACHLOR		0.000449	UJ	C	0.000538	UJ	C	0.00043	UJ	C	0.000448	UJ	C
HEPTACHLOR EPOXIDE		0.000449	U		0.000538	U		0.00043	U		0.00092		
METHOXYCHLOR		0.000449	UJ	C	0.000538	UJ	C	0.00043	UJ	CD	0.000448	UJ	C
TOXAPHENE		0.0227	UJ	C	0.0272	UJ	C	0.0218	UJ	C	0.0227	UJ	C

PROJ_NO: 01021	NSAMPLE	NTC17PCSD63			NTC17PCSD64			NTC17PCSD65			NTC17PCSD66		
SDG: 1204004	LAB_ID	1204004-04			1204004-05			1204004-18			1204004-19		
FRACTION: PEST	SAMP_DATE	3/27/2012			3/27/2012			3/29/2012			3/29/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.7			68.0			62.2			66.0		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
4,4'-DDD		0.0665	J	C	0.0484	J	C	0.00608	J	C	0.0234	J	C
4,4'-DDE		0.112	J	E	0.0425	J	E	0.00601			0.026		
4,4'-DDT		0.134	J	C	0.0662	J	C	0.0008	J	CP	0.00469	J	C
ALDRIN		0.00215	U		0.000473	U		0.00029	J	P	0.000497	U	
ALPHA-BHC		0.00215	U		0.000473	U		0.000527	U		0.00019	J	CP
ALPHA-CHLORDANE		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
BETA-BHC		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
DELTA-BHC		0.00215	U		0.000473	U		0.00024	J	CP	0.00031	J	CP
DIELDRIN		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
ENDOSULFAN I		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
ENDOSULFAN II		0.00215	U		0.00134			0.00057	J	P	0.00205		
ENDOSULFAN SULFATE		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
ENDRIN		0.00887			0.00421			0.000527	U		0.00083	J	P
ENDRIN ALDEHYDE		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
ENDRIN KETONE		0.00215	U		0.000473	U		0.000527	UJ	C	0.000497	UJ	C
GAMMA-BHC (LINDANE)		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
GAMMA-CHLORDANE		0.00185	J	P	0.00046	J	CP	0.00318	U	A	0.00065	U	A
HEPTACHLOR		0.00215	UJ	C	0.000473	UJ	C	0.000527	UJ	C	0.000497	UJ	C
HEPTACHLOR EPOXIDE		0.00215	U		0.000473	U		0.000527	U		0.000497	U	
METHOXYCHLOR		0.00215	UJ	C	0.000473	UJ	C	0.000527	UJ	C	0.000497	UJ	C
TOXAPHENE		0.109	UJ	C	0.0239	UJ	C	0.0267	UJ	C	0.0251	UJ	C

PROJ_NO: 01021	NSAMPLE	NTC17PCSD67			NTC17PCSD68			NTC17PCSD69			NTC17PCSD70		
SDG: 1204004	LAB_ID	1204004-21			1204004-22			1204004-20			1204004-10		
FRACTION: PEST	SAMP_DATE	3/29/2012			3/29/2012			3/29/2012			3/28/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	59.7			60.5			70.4			44.9		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
4,4'-DDD		0.0147	J	C	0.0254	J	C	0.0063	J	C	0.00079	J	CPRU
4,4'-DDE		0.0225			0.0323			0.0142			0.00221	J	EU
4,4'-DDT		0.00915	J	C	0.00414	J	C	0.00794	J	C	0.000734	UJ	C
ALDRIN		0.00051	J	CP	0.00069	J	CP	0.000462	U		0.000734	U	
ALPHA-BHC		0.000549	U		0.000545	U		0.000462	U		0.000734	U	
ALPHA-CHLORDANE		0.00169			0.000545	U		0.000462	U		0.000734	U	
BETA-BHC		0.000549	U		0.000545	U		0.000462	U		0.000734	U	
DELTA-BHC		0.0006	J	CP	0.00133	J	C	0.00044	J	CP	0.000734	U	
DIELDRIN		0.00143			0.00204	J	C	0.000462	U		0.000734	U	
ENDOSULFAN I		0.000549	U		0.000545	U		0.000462	U		0.000734	U	
ENDOSULFAN II		0.00137			0.00118	J	C	0.00165	J	C	0.00224	J	U
ENDOSULFAN SULFATE		0.00038	J	P	0.00081	J	CP	0.000462	U		0.000734	U	
ENDRIN		0.00088	J	CP	0.00073	J	CP	0.00128			0.000734	U	
ENDRIN ALDEHYDE		0.000549	U		0.000545	U		0.000462	U		0.000734	U	
ENDRIN KETONE		0.000549	U		0.000545	U		0.000462	U		0.000734	UJ	C
GAMMA-BHC (LINDANE)		0.000549	U		0.000545	U		0.000462	U		0.000734	U	
GAMMA-CHLORDANE		0.00079	U	A	0.00192	U	A	0.00037	U	A	0.00392	J	U
HEPTACHLOR		0.000549	U		0.000545	U		0.000462	U		0.000734	UJ	C
HEPTACHLOR EPOXIDE		0.000549	U		0.00024	J	CP	0.000462	U		0.000734	U	
METHOXYCHLOR		0.000549	UJ	C	0.000545	UJ	C	0.00139	J	C	0.000734	UJ	C
TOXAPHENE		0.0278	UJ	C	0.0276	UJ	C	0.0234	UJ	C	0.0372	UJ	C

PROJ_NO: 01021 SDG: 1204004 FRACTION: PEST MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD71			NTC17PCSD72		
	LAB_ID	1204004-11			1204004-12		
	SAMP_DATE	3/28/2012			3/28/2012		
	QC_TYPE	NM			NM		
	UNITS	MG/KG			MG/KG		
	PCT_SOLIDS	70.4			75.6		
	DUP_OF						
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD
4,4'-DDD		0.00087	J	CP	0.00096	J	CRU
4,4'-DDE		0.00036	J	CP	0.00037	J	CEPRU
4,4'-DDT		0.00375	J	C	0.00414	J	CRU
ALDRIN		0.00072	J	CP	0.000437	U	
ALPHA-BHC		0.00056	J	P	0.00087	J	CPRU
ALPHA-CHLORDANE		0.000468	U		0.000437	U	
BETA-BHC		0.000468	U		0.000437	U	
DELTA-BHC		0.00043	J	P	0.000437	U	
DIELDRIN		0.000468	U		0.00029	J	PU
ENDOSULFAN I		0.000468	U		0.000437	U	
ENDOSULFAN II		0.00245			0.0025		
ENDOSULFAN SULFATE		0.000468	U		0.000437	U	
ENDRIN		0.00085	J	P	0.00077	J	CPR
ENDRIN ALDEHYDE		0.000468	U		0.000437	U	
ENDRIN KETONE		0.000468	UJ	C	0.000437	UJ	C
GAMMA-BHC (LINDANE)		0.00079	J	P	0.00134	J	CRU
GAMMA-CHLORDANE		0.00263			0.00301	J	U
HEPTACHLOR		0.000468	UJ	C	0.000437	UJ	C
HEPTACHLOR EPOXIDE		0.000468	U		0.000437	U	
METHOXYCHLOR		0.000468	UJ	C	0.00198	J	CR
TOXAPHENE		0.0237	UJ	C	0.0221	UJ	C

PROJ_NO: 01021	NSAMPLE	RB033012-01
SDG: 1204004	LAB_ID	1204004-23
FRACTION: PCB	SAMP_DATE	3/30/2012
MEDIA: WATER	QC_TYPE	NM
	UNITS	UG/L
	PCT_SOLIDS	0.0
	DUP_OF	

PARAMETER	RESULT	VQL	QLCD
AROCLOR-1016	0.236	U	
AROCLOR-1221	0.236	U	
AROCLOR-1232	0.236	U	
AROCLOR-1242	0.236	U	
AROCLOR-1248	0.236	U	
AROCLOR-1254	0.236	U	
AROCLOR-1260	0.236	U	

PROJ_NO: 01021 SDG: 1204004 FRACTION: PCB MEDIA: SEDIMENT	NSAMPLE	FD032812-01			FD032812-02			NTC17PCSD53			NTC17PCSD54		
	LAB_ID	1204004-09			1204004-15			1204004-16			1204004-14		
	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/28/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.9			73.0			68.6			71.2		
	DUP_OF	NTC17PCSD61			NTC17PCSD53								
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
AROCLOR-1016		0.0104	U		0.011	U		0.0121	U		0.0117	U	
AROCLOR-1221		0.0104	U		0.011	U		0.0121	U		0.0117	U	
AROCLOR-1232		0.0104	U		0.011	U		0.0121	U		0.0117	U	
AROCLOR-1242		0.0104	U		0.011	U		0.0121	U		0.0117	U	
AROCLOR-1248		0.0104	U		0.011	U		0.0121	U		0.0117	U	
AROCLOR-1254		0.0104	U		0.011	U		0.0121	U		0.0117	U	
AROCLOR-1260		0.0104	U		0.011	U		0.0121	U		0.0117	U	

PROJ_NO: 01021 SDG: 1204004 FRACTION: PCB MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD55			NTC17PCSD56			NTC17PCSD57			NTC17PCSD58		
	LAB_ID	1204004-01			1204004-02			1204004-03			1204004-17		
	SAMP_DATE	3/27/2012			3/27/2012			3/27/2012			3/29/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	82.3			77.2			80.3			77.8		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
AROCLOR-1016		0.0098	U		0.0532	U		0.0102	U		0.0103	U	
AROCLOR-1221		0.0098	U		0.0532	U		0.0102	U		0.0103	U	
AROCLOR-1232		0.0098	U		0.0532	U		0.0102	U		0.0103	U	
AROCLOR-1242		0.0098	U		0.0532	U		0.0102	U		0.0103	U	
AROCLOR-1248		0.0098	U		0.0532	U		0.0102	U		0.0103	U	
AROCLOR-1254		0.0098	U		0.0532	U		0.0102	U		0.0103	U	
AROCLOR-1260		0.0352	J	E	0.0586	J	CEP	0.0102	U		0.0103	U	

PROJ_NO: 01021 SDG: 1204004 FRACTION: PCB MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD59			NTC17PCSD60			NTC17PCSD61			NTC17PCSD62		
	LAB_ID	1204004-13			1204004-08			1204004-07			1204004-06		
	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/27/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	72.1			60.6			75.2			73.7		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
AROCLOR-1016		0.0113	U		0.0136	U		0.0109	U		0.0113	U	
AROCLOR-1221		0.0113	U		0.0136	U		0.0109	U		0.0113	U	
AROCLOR-1232		0.0113	U		0.0136	U		0.0109	U		0.0113	U	
AROCLOR-1242		0.0113	U		0.0136	U		0.0109	U		0.0113	U	
AROCLOR-1248		0.0113	U		0.0136	U		0.0109	U		0.0113	U	
AROCLOR-1254		0.0113	U		0.0136	U		0.0109	U		0.0113	U	
AROCLOR-1260		0.0113	U		0.0136	U		0.0109	U		0.0263	J	E

PROJ_NO: 01021 SDG: 1204004 FRACTION: PCB MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD63			NTC17PCSD64			NTC17PCSD65			NTC17PCSD66		
	LAB_ID	1204004-04			1204004-05			1204004-18			1204004-19		
	SAMP_DATE	3/27/2012			3/27/2012			3/29/2012			3/29/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.7			68.0			62.2			66.0		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
AROCLOR-1016		0.0543	U		0.0119	U		0.0133	U		0.0125	U	
AROCLOR-1221		0.0543	U		0.0119	U		0.0133	U		0.0125	U	
AROCLOR-1232		0.0543	U		0.0119	U		0.0133	U		0.0125	U	
AROCLOR-1242		0.0543	U		0.0119	U		0.0133	U		0.0125	U	
AROCLOR-1248		0.0543	U		0.0119	U		0.0133	U		0.0125	U	
AROCLOR-1254		0.0543	U		0.0119	U		0.0133	U		0.0125	U	
AROCLOR-1260		0.0543	U		0.0119	U		0.0133	U		0.0125	U	

PROJ_NO: 01021 SDG: 1204004 FRACTION: PCB MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD67			NTC17PCSD68			NTC17PCSD69			NTC17PCSD70		
	LAB_ID	1204004-21			1204004-22			1204004-20			1204004-10		
	SAMP_DATE	3/29/2012			3/29/2012			3/29/2012			3/28/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	59.7			60.5			70.4			44.9		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
AROCLOR-1016		0.0139	U		0.0138	U		0.0117	U		0.0185	U	
AROCLOR-1221		0.0139	U		0.0138	U		0.0117	U		0.0185	U	
AROCLOR-1232		0.0139	U		0.0138	U		0.0117	U		0.0185	U	
AROCLOR-1242		0.0139	U		0.0138	U		0.0117	U		0.0185	U	
AROCLOR-1248		0.0139	U		0.0138	U		0.0117	U		0.0185	U	
AROCLOR-1254		0.0139	U		0.0138	U		0.0117	U		0.0185	U	
AROCLOR-1260		0.0139	U		0.0138	U		0.0117	U		0.0707	J	EU

PROJ_NO: 01021 SDG: 1204004 FRACTION: PCB MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD71			NTC17PCSD72		
	LAB_ID	1204004-11			1204004-12		
	SAMP_DATE	3/28/2012			3/28/2012		
	QC_TYPE	NM			NM		
	UNITS	MG/KG			MG/KG		
	PCT_SOLIDS	70.4			75.6		
	DUP_OF						
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD
AROCLOR-1016		0.0118	U		0.011	U	
AROCLOR-1221		0.0118	U		0.011	U	
AROCLOR-1232		0.0118	U		0.011	U	
AROCLOR-1242		0.0118	U		0.011	U	
AROCLOR-1248		0.0118	U		0.011	U	
AROCLOR-1254		0.0118	U		0.011	U	
AROCLOR-1260		0.0118	U		0.025	J	EU

Tetra Tech **INTERNAL CORRESPONDENCE**

TO:	**B. Davis**	**DATE:**	**May 2nd, 2012**
FROM:	**MEGAN CARSON**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – SELECT METALS, TOC, AND pH**
NTC GREAT LAKES CTO 474
SAMPLE DELIVERY GROUP (SDG) – 1204004

SAMPLES: 22/Sediment/

FD032812-01	FD032812-02	NTC17PCSD53
NTC17PCSD54	NTC17PCSD55	NTC17PCSD56
NTC17PCSD57	NTC17PCSD58	NTC17PCSD59
NTC17PCSD60	NTC17PCSD61	NTC17PCSD62
NTC17PCSD63	NTC17PCSD64	NTC17PCSD65
NTC17PCSD66	NTC17PCSD67	NTC17PCSD68
NTC17PCSD69	NTC17PCSD70	NTC17PCSD71
NTC17PCSD72		

1/Water/
RB033012-01

Overview

The sample set for NTC Great Lakes CTO 474, SDG 1204004, consists of twenty-two (22) sediment environmental samples and one rinsate blank. This SDG contained two field duplicate pair: FD032812-01/NTC17PCSD61 and FD032812-02/NTC17PCSD53.

All samples were analyzed for arsenic, cadmium, chromium, copper, lead, mercury, zinc and total organic carbon (TOC). Samples FD032812-02, NTC17PCSD53, NTC17PCSD58, NTC17PCSD59, NTC17PCSD61, NTC17PCSD63, NTC17PCSD65, and NTC17PCSD67 were analyzed for pH. The samples were collected by Tetra Tech NUS on March 27th, 28th, and 29th, 2012 and analyzed by Empirical Laboratories LLC. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Metals analyses were conducted using SW-846 method 6010C. Mercury analyses were conducted using methods 7471 and 7470.

Samples FD032812-01, FD032812-02, NTC17PCSD53, NTC17PCSD61, NTC17PCSD70, and NTC17PCSD72 were evaluated based on the following:

* • Data Completeness
* • Holding Times
* • Initial and Continuing Calibrations
* • Laboratory Method / Preparation Blanks
* • ICP Interference Analysis
* • Laboratory Control Sample Recoveries
- • Matrix Spike / Matrix Spike Duplicate Recoveries
* • ICP Serial Dilution Results
* • Internal Standard Recoveries
* • Field Duplicate Results
* • Laboratory Duplicate Results

- * • Detection Limits
- * • Analyte Quantitation

  * - All quality control criteria were met for this parameter.

All samples (except for samples FD032812-01, FD032812-02, NTC17PCSD53, NTC17PCSD61, NTC17PCSD70, and NTC17PCSD72) were evaluated based on the following:

- * • Data Completeness
- * • Holding Times
- * • Initial and Continuing Calibrations
- * • Laboratory Method / Preparation Blanks
- * • Field Duplicate Results
- * • Detection Limits

  * - All quality control criteria were met for this parameter.

Qualified (if applicable) analytical results are summarized in Appendix A. Results as reported by the laboratory are presented in Appendix B. Appendix C contains the documentation to support the findings as discussed in this validation report.

Full Validation:

The matrix spike for preparation batch 2D09811 had percent recoveries > 120% for copper and zinc. All samples in preparation batch 2D09811 were affected. Positive results were qualified as estimated (J).

The matrix spike for preparation batch 2D09812 had a percent recovery > 120% for zinc. All samples in preparation batch 2D09812 were affected. Positive results were qualified as estimated (J).

The matrix spike for preparation batch 2D10115 had a percent recovery > 120% for TOC. All samples in preparation batch 2D10115 were affected. Positive results were qualified as estimated (J).

Limited Validation:

All sample results were within quality control limits.

Notes

The following contaminant was detected in preparation blanks at the following maximum concentration:

Analyte	Maximum Concentration	Action Level
Zinc (1)	0.31 mg/kg	1.55 mg/kg
Zinc (2)	0.27 mg/kg	1.35 mg/kg

(1) Maximum concentration found in a preparation blank affecting samples in preparation batch 2D09811.
(2) Maximum concentration found in a preparation blank affecting samples in preparation batch 2D09812.

An action level of 5X the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot, percent solids, and dilution factors were taken into consideration when evaluating for blank contamination. No validation action was warranted as sample results were greater than the blank action level.

Several samples were analyzed at 5X dilutions.

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: High matrix spike recoveries were noted for copper, zinc and TOC affecting several samples.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", October 2004, and the DOD document entitled "Quality System Manual (QSM) for Environmental Laboratories" (April, 2009).

The text of this report has been formulated to address only those problem areas affecting data quality.

Megan Carson

Tetra Tech
Megan Carson
Chemist/Data Validator

Tetra Tech
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A	=	Lab Blank Contamination
B	=	Field Blank Contamination
C	=	Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01	=	GC/MS Tuning Noncompliance
D	=	MS/MSD Recovery Noncompliance
E	=	LCS/LCSD Recovery Noncompliance
F	=	Lab Duplicate Imprecision
G	=	Field Duplicate Imprecision
H	=	Holding Time Exceedance
I	=	ICP Serial Dilution Noncompliance
J	=	ICP PDS Recovery Noncompliance; MSA's r < 0.995
K	=	ICP Interference - includes ICS % R Noncompliance
L	=	Instrument Calibration Range Exceedance
M	=	Sample Preservation Noncompliance
N	=	Internal Standard Noncompliance
N01	=	Internal Standard Recovery Noncompliance Dioxins
N02	=	Recovery Standard Noncompliance Dioxins
N03	=	Clean-up Standard Noncompliance Dioxins
O	=	Poor Instrument Performance (i.e., base-time drifting)
P	=	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q	=	Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R	=	Surrogates Recovery Noncompliance
S	=	Pesticide/PCB Resolution
T	=	% Breakdown Noncompliance for DDT and Endrin
U	=	RPD between columns/detectors >40% for positive results determined via GC/HPLC
V	=	Non-linear calibrations; correlation coefficient r < 0.995
W	=	EMPC result
X	=	Signal to noise response drop
Y	=	Percent solids <30%
Z	=	Uncertainty at 2 sigma deviation is less than sample activity
Z1	=	Tentatively Identified Compound considered presumptively present
Z2	=	Tentatively Identified Compound column bleed

PROJ_NO: 01021 **SDG: 1204004** **FRACTION: M** **MEDIA: WATER**	NSAMPLE	RB033012-01
	LAB_ID	1204004-23
	SAMP_DATE	3/30/2012
	QC_TYPE	NM
	UNITS	UG/L
	PCT_SOLIDS	0.0
	DUP_OF	

PARAMETER	RESULT	VQL	QLCD
ARSENIC	1.5	U	
CADMIUM	0.5	U	
CHROMIUM	1	U	
COPPER	2	U	
LEAD	0.75	U	
MERCURY	0.2	U	
ZINC	2.5	U	

PROJ_NO: 01021 SDG: 1204004 FRACTION: M MEDIA: SEDIMENT	NSAMPLE	FD032812-01			FD032812-02			NTC17PCSD53			NTC17PCSD54		
	LAB_ID	1204004-09			1204004-15			1204004-16			1204004-14		
	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/28/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.9			73.0			68.6			71.2		
	DUP_OF	NTC17PCSD61			NTC17PCSD53								
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
ARSENIC		6.97			8.58			9.46			7.26		
CADMIUM		0.657	U		0.674	J	P	0.445	J	P	0.717	U	
CHROMIUM		16.3			22.6			23.4			19.2		
COPPER		29.3	J	D	77.6			68.3			43.5	J	D
LEAD		17.8			105			96.7			30		
MERCURY		0.0322	J	P	0.126			0.17			0.124		
ZINC		121	J	D	381	J	D	384	J	D	131		

PROJ_NO: 01021 SDG: 1204004 FRACTION: M MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD55			NTC17PCSD56			NTC17PCSD57			NTC17PCSD58		
	LAB_ID	1204004-01			1204004-02			1204004-03			1204004-17		
	SAMP_DATE	3/27/2012			3/27/2012			3/27/2012			3/29/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	82.3			77.2			80.3			77.8		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
ARSENIC		5.55			6.79			5.54			7.47		
CADMIUM		0.398	J	P	0.451	J	P	0.61	U		0.627	U	
CHROMIUM		14.3			17.7			15.6			15.8		
COPPER		222	J	D	62.2	J	D	37.2	J	D	34.7		
LEAD		109			67.5			21.8			29		
MERCURY		0.159			0.181			0.0442			0.0329	J	P
ZINC		1180			224			96.7			107	J	D

PROJ_NO: 01021 SDG: 1204004 FRACTION: M MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD59			NTC17PCSD60			NTC17PCSD61			NTC17PCSD62		
	LAB_ID	1204004-13			1204004-08			1204004-07			1204004-06		
	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012			3/27/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	72.1			60.6			75.2			73.7		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
ARSENIC		7.34			6.94			8.02			5.57		
CADMIUM		0.69	U		0.454	J	P	0.678	U		0.789	J	P
CHROMIUM		19.1			18			15.2			19.9		
COPPER		46.2	J	D	89.6	J	D	28.5	J	D	50.6	J	D
LEAD		29.6			56.8			15.4			33.7		
MERCURY		0.0652			0.132			0.0289	J	P	0.171		
ZINC		141			329			85.5	J	D	56.7		

PROJ_NO: 01021 SDG: 1204004 FRACTION: M MEDIA: SEDIMENT												
	NSAMPLE	NTC17PCSD63			NTC17PCSD64			NTC17PCSD65			NTC17PCSD66		
	LAB_ID	1204004-04			1204004-05			1204004-18			1204004-19		
	SAMP_DATE	3/27/2012			3/27/2012			3/29/2012			3/29/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	76.7			68.0			62.2			66.0		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
ARSENIC		6.67			7.77			6.34			6.91		
CADMIUM		0.39	J	P	0.707	U		0.808	U		0.725	U	
CHROMIUM		26.5			13.9			17.8			17.8		
COPPER		70.3	J	D	92.3	J	D	26.6			36.8		
LEAD		102			64.8			24			33.8		
MERCURY		0.157			0.22			0.0654			0.169		
ZINC		299			357			91.8	J	D	144	J	D

PROJ_NO: 01021 SDG: 1204004 FRACTION: M MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD67			NTC17PCSD68			NTC17PCSD69			NTC17PCSD70		
	LAB_ID	1204004-21			1204004-22			1204004-20			1204004-10		
	SAMP_DATE	3/29/2012			3/29/2012			3/29/2012			3/28/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	MG/KG			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	59.7			60.5			70.4			44.9		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
ARSENIC		6.45			6.46			7.59			13.5		
CADMIUM		0.805	U		0.0866	J	P	0.703	U		2.4	J	P
CHROMIUM		17.7			11			20.7			33.2		
COPPER		31			27.4			40.6			390	J	D
LEAD		25.8			24.6			53.6			220		
MERCURY		0.632			0.203			0.061			0.366		
ZINC		104	J	D	96	J	D	146	J	D	1580	J	D

PROJ_NO: 01021 SDG: 1204004 FRACTION: M MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD71			NTC17PCSD72		
	LAB_ID	1204004-11			1204004-12		
	SAMP_DATE	3/28/2012			3/28/2012		
	QC_TYPE	NM			NM		
	UNITS	MG/KG			MG/KG		
	PCT_SOLIDS	70.4			75.6		
	DUP_OF						
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD
ARSENIC		5.41			6.73		
CADMIUM		1.32	J	P	0.679	U	
CHROMIUM		22.9			21.3		
COPPER		251	J	D	94.3	J	D
LEAD		144			29.7		
MERCURY		0.96			0.193		
ZINC		848			300	J	D

PROJ_NO: 01021	NSAMPLE	FD032812-01			FD032812-02						NTC17PCSD53		
SDG: 1204004	LAB_ID	1204004-09			1204004-15						1204004-16		
FRACTION: MISC	SAMP_DATE	3/28/2012			3/28/2012						3/28/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM						NM		
	UNITS	MG/KG			MG/KG			S.U.			MG/KG		
	PCT_SOLIDS	76.9			73.0			199.0			68.6		
	DUP_OF	NTC17PCSD61			NTC17PCSD53			NTC17PCSD53					
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH								7.7					
TOTAL ORGANIC CARBON		12900			20200	J	D				22000	J	D

PROJ_NO: 01021	NSAMPLE	NTC17PCSD53			NTC17PCSD54			NTC17PCSD55			NTC17PCSD56		
SDG: 1204004	LAB_ID	1204004-16			1204004-14			1204004-01			1204004-02		
FRACTION: MISC	SAMP_DATE	3/28/2012			3/28/2012			3/27/2012			3/27/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM			NM		
	UNITS	S.U.			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	199.0			71.2			82.3			77.2		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH		7.63											
TOTAL ORGANIC CARBON					18900			18600			22800		

PROJ_NO: 01021	NSAMPLE	NTC17PCSD57			NTC17PCSD58						NTC17PCSD59		
SDG: 1204004	LAB_ID	1204004-03			1204004-17						1204004-13		
FRACTION: MISC	SAMP_DATE	3/27/2012			3/29/2012						3/28/2012		
MEDIA: SEDIMENT	QC_TYPE	NM			NM						NM		
	UNITS	MG/KG			MG/KG			S.U.			MG/KG		
	PCT_SOLIDS	80.3			77.8			199.0			72.1		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH								7.73					
TOTAL ORGANIC CARBON		17900			11900						11600		

PROJ_NO: 01021	NSAMPLE	NTC17PCSD59			NTC17PCSD60			NTC17PCSD61					
SDG: 1204004	LAB_ID	1204004-13			1204004-08			1204004-07					
FRACTION: MISC	SAMP_DATE	3/28/2012			3/28/2012			3/28/2012					
MEDIA: SEDIMENT	QC_TYPE	NM			NM			NM					
	UNITS	S.U.			MG/KG			MG/KG			S.U.		
	PCT_SOLIDS	199.0			60.6			75.2			199.0		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH		7.65									7.75		
TOTAL ORGANIC CARBON					36700			11000	J	D			

PROJ_NO: 01021 SDG: 1204004 FRACTION: MISC MEDIA: SEDIMENT												
NSAMPLE	NTC17PCSD62			NTC17PCSD63						NTC17PCSD64		
LAB_ID	1204004-06			1204004-04						1204004-05		
SAMP_DATE	3/27/2012			3/27/2012						3/27/2012		
QC_TYPE	NM			NM						NM		
UNITS	MG/KG			MG/KG			S.U.			MG/KG		
PCT_SOLIDS	73.7			76.7			199.0			68.0		
DUP_OF												
PARAMETER	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH							7.4					
TOTAL ORGANIC CARBON	24100			10200						22100		

PROJ_NO: 01021	NSAMPLE	NTC17PCSD65						NTC17PCSD66			NTC17PCSD67		
SDG: 1204004	LAB_ID	1204004-18						1204004-19			1204004-21		
FRACTION: MISC	SAMP_DATE	3/29/2012						3/29/2012			3/29/2012		
MEDIA: SEDIMENT	QC_TYPE	NM						NM			NM		
	UNITS	MG/KG			S.U.			MG/KG			MG/KG		
	PCT_SOLIDS	62.2			199.0			66.0			59.7		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH					7.34								
TOTAL ORGANIC CARBON		13900						18100			29000		

PROJ_NO: 01021 SDG: 1204004 FRACTION: MISC MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD67			NTC17PCSD68			NTC17PCSD69			NTC17PCSD70		
	LAB_ID	1204004-21			1204004-22			1204004-20			1204004-10		
	SAMP_DATE	3/29/2012			3/29/2012			3/29/2012			3/28/2012		
	QC_TYPE	NM			NM			NM			NM		
	UNITS	S.U.			MG/KG			MG/KG			MG/KG		
	PCT_SOLIDS	199.0			60.5			70.4			44.9		
	DUP_OF												
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH		7.21											
TOTAL ORGANIC CARBON					21500			33100			71300		

PROJ_NO: 01021 SDG: 1204004 FRACTION: MISC MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD71			NTC17PCSD72		
	LAB_ID	1204004-11			1204004-12		
	SAMP_DATE	3/28/2012			3/28/2012		
	QC_TYPE	NM			NM		
	UNITS	MG/KG			MG/KG		
	PCT_SOLIDS	70.4			75.6		
	DUP_OF						
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD
PH							
TOTAL ORGANIC CARBON		29000			12900	J	D

5/2/2012

Tetra Tech **INTERNAL CORRESPONDENCE**

TO:	**B. Davis**	**DATE:**	**July 17, 2012**
FROM:	**MEGAN CARSON**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC AND INORGANIC DATA VALIDATION – PAHs, PEST, PCB, SELECT METALS, NTC GREAT LAKES CTO F275 SAMPLE DELIVERY GROUP (SDG) – 1206096**

SAMPLES: 2/Sediment/
NTC17PCSD50 NTC17PCSD51-52

Overview

The sample set for NTC Great Lakes CTO F275, SDG 1206096, consists of two (2) sediment environmental samples. This SDG contained no field duplicate pairs.

All samples were analyzed for select metals. Sample NTC17PCSD50 was analyzed for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCB), and pesticides (PEST). The samples were collected by Tetra Tech on June 14th, 2012 and analyzed by Empirical Laboratories LLC. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Metals analyses were conducted using SW-846 method 6010C. Mercury analyses were conducted using method 7471A. PAH analyses were conducted using method 8270D. Pesticide analyses were conducted using method 8081A. PCB analyses were conducted using method 8082A.

The data contained in this SDG were validated with regard to the following parameters:

* • Data Completeness
* • Holding Times
* • Instrument performance and tuning
• Initial and Continuing Calibrations
• Laboratory Method / Preparation Blanks
* • ICP Interference Analysis
• Laboratory Control Sample Recoveries
• Matrix Spike / Matrix Spike Duplicate Recoveries
* • ICP Serial Dilution Results
• Surrogate Recoveries
* • Internal Standard Recoveries
* • Field Duplicate Results
* • Laboratory Duplicate Results
* • Detection Limits
• Analyte Quantitation

* - All quality control criteria were met for this parameter.

Qualified (if applicable) analytical results are summarized in Appendix A. Results as reported by the laboratory are presented in Appendix B. Appendix C contains the documentation to support the findings as discussed in this validation report.

PAH:

No data quality issues were noted.

PCB:

Sample NTC17PCSD50 had percent recoveries > 125% for surrogates tertrachloro-m-xylene (column 1 and 2) and decachlorobiphenyl (column 1). The positive Aroclor-1260 result was qualified a estimated (J) and non-detected results were not qualified.

PEST:

The initial calibration analyzed on 6/26/12 had a relative standard deviation > 20% for 4,4-DDT (column 1) but the coefficient of determination (COD) was acceptable. No action was required.

The continuing calibration analyzed on 6/27/12 at 12:32 had difference > 20% for 4,4-DDE (both columns), 4,4-DDD (both columns), heptachlor (column 1), and methoxychlor (column 1). The positive 4,4-DDE result was qualified as estimated (J). The non-detected 4,4-DDD result was qualified as estimated (UJ). No validation action was taken for heptachlor and methoxychlor as the non-compliance occurred on only one column and the results were non-detected.

The continuing calibration analyzed on 6/27/12 at 14:44 had difference > 20% for 4,4-DDE (both columns), 4,4-DDD (both columns), 4,4-DDT (column 2), beta-BHC (column 1), delta-BHC (column 2), heptachlor (both columns), and methoxychlor (column 1). The positive 4,4-DDE and beta-BHC results were qualified as estimated (J). The non-detected 4,4-DDD and heptachlor results were qualified as estimated (UJ). No validation action was taken for delta-BHC and methoxychlor as the non-compliance occurred on only one column and the results were non-detected.

The laboratory control spike had percent recoveries greater than the upper control limit for 4,4-DDE (column 1) and 4,4'-DDD (column 2). The positive 4,4-DDE result was qualified as estimated (J). No validation action was taken for 4,4-DDD because the results were non-detected.

Sample NTC17PCSD50 had percent recoveries > 125% for surrogate tertrachloro-m-xylene (column 1 and 2). All positive results were qualified as estimated (J).

The relative percent difference between columns was greater than 40% for 4,4-DDE, 4,4-DDT, dieldrin, endrin aldehyde, and endrin ketone results. All positive results were qualified as estimated (J).

Metals:

The matrix spike duplicate had a percent recovery < 80% for mercury. Matrix spike percent recoveries were within control limits. Both samples were affected. Positive results were qualified as estimated (J).

Notes

The following contaminant was detected in preparation blank at the following maximum concentration:

Analyte	Maximum Concentration	Action Level
Zinc	0.26 mg/kg	1.3 mg/kg

An action level of 5X the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot, percent solids, and dilution factors were taken into consideration when evaluating for blank contamination. No validation action was warranted as sample results were greater than the blank action level.

All positive pesticide and PCB results were reported from column one. Reporting of the results in this fashion is not consistent with the SW846 8000 methodology requirements and the SAP; however, no action was taken by the data reviewer.

PAH, pesticide, and PCB analyses were not performed on sample NTC17PCSD51-52 as per the chain of custody due to low sample volume. The project manager was notified of the issue and requested that only metals analyses be conducted.

Twenty-one compounds were reported for the pesticide fraction instead of the seven referenced in the SAP. No action was taken.

Executive Summary

Laboratory Performance: Initial and continuing calibration non-compliances resulted in the qualification of sample results. LCS non-compliances resulted in the qualification of sample results.

Other Factors Affecting Data Quality: Surrogate non-compliances resulted in the qualification of sample results. Non-compliances for percent differences between columns for pesticides resulted in the qualification of sample results.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", October 2004, "National Functional Guidelines for Organic Review", October 1999 and the DOD document entitled "Quality System Manual (QSM) for Environmental Laboratories" (April, 2009).

The text of this report has been formulated to address only those problem areas affecting data quality.

Megan Carson
Tetra Tech
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Chemist/Data Validator

Tetra Tech
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A	=	Lab Blank Contamination
B	=	Field Blank Contamination
C	=	Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01	=	GC/MS Tuning Noncompliance
D	=	MS/MSD Recovery Noncompliance
E	=	LCS/LCSD Recovery Noncompliance
F	=	Lab Duplicate Imprecision
G	=	Field Duplicate Imprecision
H	=	Holding Time Exceedance
I	=	ICP Serial Dilution Noncompliance
J	=	ICP PDS Recovery Noncompliance; MSA's r < 0.995
K	=	ICP Interference - includes ICS % R Noncompliance
L	=	Instrument Calibration Range Exceedance
M	=	Sample Preservation Noncompliance
N	=	Internal Standard Noncompliance
N01	=	Internal Standard Recovery Noncompliance Dioxins
N02	=	Recovery Standard Noncompliance Dioxins
N03	=	Clean-up Standard Noncompliance Dioxins
O	=	Poor Instrument Performance (i.e., base-time drifting)
P	=	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q	=	Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R	=	Surrogates Recovery Noncompliance
S	=	Pesticide/PCB Resolution
T	=	% Breakdown Noncompliance for DDT and Endrin
U	=	RPD between columns/detectors >40% for positive results determined via GC/HPLC
V	=	Non-linear calibrations; correlation coefficient r < 0.995
W	=	EMPC result
X	=	Signal to noise response drop
Y	=	Percent solids <30%
Z	=	Uncertainty at 2 sigma deviation is less than sample activity
Z1	=	Tentatively Identified Compound considered presumptively present
Z2	=	Tentatively Identified Compound column bleed

PROJ_NO: 02120 **SDG: 1206096** **FRACTION: PAH** **MEDIA: SEDIMENT**	NSAMPLE	NTC17PCSD50
	LAB_ID	1206096-01
	SAMP_DATE	6/14/2012
	QC_TYPE	NM
	UNITS	MG/KG
	PCT_SOLIDS	92.0
	DUP_OF	

PARAMETER	RESULT	VQL	QLCD
2-METHYLNAPHTHALENE	0.0357	U	
ACENAPHTHENE	0.0808		
ACENAPHTHYLENE	0.0357	U	
ANTHRACENE	0.165		
BENZO(A)ANTHRACENE	0.722		
BENZO(A)PYRENE	0.922		
BENZO(B)FLUORANTHENE	1.11		
BENZO(G,H,I)PERYLENE	0.552		
BENZO(K)FLUORANTHENE	1.02		
CHRYSENE	1.06		
DIBENZO(A,H)ANTHRACENE	0.123		
FLUORANTHENE	2.38		
FLUORENE	0.0858		
INDENO(1,2,3-CD)PYRENE	0.526		
NAPHTHALENE	0.0357	U	
PHENANTHRENE	1.19		
PYRENE	1.84		

PROJ_NO: 02120 **SDG: 1206096** **FRACTION: PEST** **MEDIA: SEDIMENT**	NSAMPLE	NTC17PCSD50
	LAB_ID	1206096-01
	SAMP_DATE	6/14/2012
	QC_TYPE	NM
	UNITS	MG/KG
	PCT_SOLIDS	92.0
	DUP_OF	

PARAMETER	RESULT	VQL	QLCD
4,4'-DDD	0.00173	UJ	C
4,4'-DDE	0.00335	J	CEPRU
4,4'-DDT	0.00793	J	RU
ALDRIN	0.00173	U	
ALPHA-BHC	0.00173	U	
ALPHA-CHLORDANE	0.00173	U	
BETA-BHC	0.00506	J	CR
DELTA-BHC	0.00173	U	
DIELDRIN	0.00163	J	PRU
ENDOSULFAN I	0.00173	U	
ENDOSULFAN II	0.00473	J	R
ENDOSULFAN SULFATE	0.00173	U	
ENDRIN	0.00354	J	R
ENDRIN ALDEHYDE	0.00259	J	PRU
ENDRIN KETONE	0.00157	J	PRU
GAMMA-BHC (LINDANE)	0.00173	U	
GAMMA-CHLORDANE	0.00961	J	R
HEPTACHLOR	0.00173	UJ	C
HEPTACHLOR EPOXIDE	0.00173	U	
METHOXYCHLOR	0.00173	U	
TOXAPHENE	0.0878	U	

PROJ_NO: 02120 **SDG: 1206096** **FRACTION: PCB** **MEDIA: SEDIMENT**	NSAMPLE	NTC17PCSD50
	LAB_ID	1206096-01
	SAMP_DATE	6/14/2012
	QC_TYPE	NM
	UNITS	MG/KG
	PCT_SOLIDS	92.0
	DUP_OF	

PARAMETER	RESULT	VQL	QLCD
AROCLOR-1016	0.0438	U	
AROCLOR-1221	0.0438	U	
AROCLOR-1232	0.0438	U	
AROCLOR-1242	0.0438	U	
AROCLOR-1248	0.0438	U	
AROCLOR-1254	0.0438	U	
AROCLOR-1260	0.334	J	R

PROJ_NO: 02120 SDG: 1206096 FRACTION: M MEDIA: SEDIMENT	NSAMPLE	NTC17PCSD50			NTC17PCSD51-52		
	LAB_ID	1206096-01			1206096-02		
	SAMP_DATE	6/14/2012			6/14/2012		
	QC_TYPE	NM			NM		
	UNITS	MG/KG			MG/KG		
	PCT_SOLIDS	92.0			46.6		
	DUP_OF						
PARAMETER		RESULT	VQL	QLCD	RESULT	VQL	QLCD
ARSENIC		27			8.94		
CADMIUM		0.823			1.44		
CHROMIUM		16.3			31.9		
COPPER		104			509		
LEAD		62.7			258		
MERCURY		0.257	J	D	0.892	J	D
ZINC		482			2960		

DATA USABILITY ASSESSMENT

DATA USABILITY ASSESSMENT
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

1.0 INTRODUCTION

This document presents the results of the data usability assessment that was conducted to ensure that the amount, type, and quality of data are sufficient to achieve the objectives of the sediment characterization report. Three primary types of data were conducted as part of this investigation: 1) sediment chemistry data, 2) benthic community survey data, and, 3) sediment toxicity test data. This document includes review of a field sample collection efforts for issues that may impact data and a data quality review (DQR).

2.0 COLLECTION OF DATA

Samples were collected from all sampling locations identified in the SAP. All analyses identified in the SAP were performed with the exception of grain size. Sediment samples collected for chemistry analysis were analyzed for additional parameters (total organic carbon and pH) to help describe habitat conditions and assist in understanding spatial distribution and magnitude of the contamination. However, the sediment samples were inadvertently not analyzed for grain size. The absence of grain size data did not impact the results of the investigation because the pebble count conducted as part of the benthic invertebrate study was adequate to characterize the sediment substrate. Also, grain size data were available from a previous sampling event. Although three suspended sediment samples were proposed for collection in the SAP, only two were collected. The sediment from locations NTC17PCSD51 and NTC17PCSD52 were combined into a single sample in order to obtain sufficient sample for analysis. However, the combined sample NTCPCSD51-52 only provided enough sediment for metals analysis, so analysis of polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides could not be conducted. The stormwater pipes associated with NTC17PCSD51 and NTC17PCSD52 generally collect from the same area so combining the sediment did not impact the conclusions of the report. Similarly, not having PAH, PCB, or pesticide data from this sample did not impact the conclusions of the report because it was just a second line of evidence regarding whether there is a continuing source of contaminants to Pettibone Creek upstream of the NSGL property. That question was answered by the upstream sediment chemistry results. No other deviations from the SAP occurred. No issues (e.g., potential contamination by samplers) were noted during sampling collection that would potentially impact the data.

3.0 DATA QUALITY REVIEW

This document contains a description of the DQR processes used to determine whether analytical laboratory data were of acceptable technical quality for use in decision making. The review began with data validation, which is a comparison of data quality indicators (DQIs) against prescribed acceptance criteria. The DQIs used are measures to assess the bias and precision of the analytical calibrations and sample analyses. The output of this review was a set of alphabetic flags such as “U,” “J,” “R,” or combinations thereof, that may have been assigned to individual results based on the validation effort. These flags were used to infer the general quality of the data. Also evaluated were the measures of data completeness, sensitivity, comparability and representativeness.

3.1 Data Validation Process

In accordance with Navy requirements for this project, Tetra Tech validated 25 percent of analytical laboratory results. Sample data validation generally followed the guidelines presented in EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (1999), and EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Validation (2004). The remaining 75 percent of the laboratory results had a significant but less rigorous level of validation. If data anomalies were apparent, the Data Validation Manager required a more detailed examination of data based on quality assurance (QA) concerns. The less rigorous validation focuses on sample integrity, adherence to sample holding times, detection limit achievement, accuracy of agreement between hard copy and electronic copy data, field duplicate precision, and blank contamination.

Data validation specifications require that various data qualifiers be assigned when a deficiency is detected or when a result is less than its detection limit. If no qualifier is assigned to a result that has been validated, the data user is assured that no technical deficiencies were identified during validation. The qualification flags used are defined below:

U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.

UJ – Indicates that the chemical was not detected; however, the detection limit (sample-specific detection limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit may be inaccurate or imprecise.

J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.

UR – Indicates that the chemical may or may not be present. The non-detected analytical result reported by the laboratory is considered to be unreliable and unusable. This qualifier is applied in cases of gross technical deficiencies (i.e., holding times missed by a factor of two or more times the specified time limit, severe calibration non-compliances, and extremely low quality control recoveries).

R – Indicates that the chemical may or not be present. The positive analytical result reported by the laboratory is considered to be unreliable and unusable. The application of this qualifier is for cases of gross technical deficiencies.

The preceding data qualifiers categorize data as indicative of major or minor problems. Major problems result in the rejection of data and qualification with UR or R data validation qualifiers. Minor problems result in the estimation of data, and qualification with U, J, and UJ data validation qualifiers. It is noteworthy that a U qualifier does not necessarily indicate that a data deficiency exists because all non-detect values are flagged with the U qualifier regardless of whether a quality deficiency has been detected.

3.2 Data Validation Outputs

After data were validated, a list was developed of non-conformities requiring data qualifier flags that were used to alert the data user to inaccurate or imprecise data. For situations in which several QC criteria were out of specification, the data validator made professional judgments and or comments on the validity of the overall data package. The reviewer then prepared a technical memorandum presenting qualification of the data, if necessary, and the rationale for making such qualifications. The net result was a data package that had been carefully reviewed for its adherence to prescribed technical requirements. Pertinent quality estimates are summarized in a more quantitative format in the following section.

3.3 Data Quality Review

DQIs are parameters that are monitored to help establish the quality of data generated during an investigation. Some of the DQIs are generated from analysis of field samples (e.g., field duplicates) and some are generated from the analysis of laboratory samples (e.g., laboratory duplicates). Individually, field and laboratory DQIs provide measures of the performance of the respective investigative operations (field or laboratory). If individual QC results were acceptable, no validation flag was assigned to an analytical result, otherwise, a flag indicating the type of QC deficiency was assigned to the result. Table 1 lists all the data that has been qualified, along with the assigned qualifiers, qualifier codes, and reasons for the qualification. No data associated with sediment characterization investigation have been rejected and all data is considered acceptable for risk assessment.

3.3.1 Completeness

Completeness is a measure of the number of valid samples or measurements that are available relative to the number of samples or measurements that were intended to be generated. For this project, completeness was measured on two different bases: samples collected and laboratory measurements.

- Sample completeness was a measure of the usable samples collected as compared to those intended to be collected.

- Laboratory measurement completeness was a measure of the amount of usable, valid laboratory measurements per matrix obtained for each target analyte.

Usable, valid samples (or results) were those judged, after data assessment, to represent the sampling populations and to have not been disqualified for use through data validation or additional data review. Completeness was determined using the following equation:

$$\%C = \frac{V}{T} \times 100$$

where	%C	=	percent completeness
	V	=	number of samples (or results) determined to be valid
	T	=	total number of planned samples (or results)

The sample collection completeness was 100%. The laboratory analytical completeness was 100% for all analytical fractions.

3.3.2 Sensitivity

The laboratory reported all results to the limit of detection (LOD) for all compounds.

Laboratory method / preparation blanks had detections for gamma-chlordane that resulted in the qualification of seven results. Laboratory field blanks had detections that resulted in the qualification of several results for carbon disulfide and acetone. No impact on data quality is expected from the gamma-chlordane blank contamination because the concentration in the blank does not exceed the laboratory limit of quantitation.

The laboratory could not meet the project screening levels for several analytes as outlined in the project sampling and analysis plan. In addition, sample dilution and percent solids increased the laboratory reporting limit of nondetected results for several other analytes causing additional exceedences of the project screening levels. The risk assessment will determine the significance, if any that the nondetected exceedances of the project screening levels have upon the data set.

3.3.3 Laboratory Accuracy

Accuracy in the laboratory is measured through the comparison of a laboratory control sample (LCS) result to a known or calculated value and is expressed as a percent recovery (%R). Surrogates and internal standards assess accuracy in organic methods. LCSs assess the accuracy of laboratory operations with minimal sample matrix effects. Matrix spike and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. Internal standards, added after preparation, are for sample quantitation. Laboratory accuracy is determined by comparing calculated percent recoveries to accuracy control limits specified by the laboratory using the appropriate analytical method.

Percent recovery is calculated using the following equation:

$$\%R = \frac{Ss - So}{S} \times 100$$

where	%R	=	percent recovery
	Ss	=	result of spiked sample
	So	=	result of non-spiked sample
	S	=	concentration of spiked amount.

Several results have been qualified due to accuracy noncompliances for calibration, matrix spike, laboratory control sample, surrogate, and uncertainty near the detection limit. The results qualified are presented in Table 1. Qualified results are typical and the amount of qualified results is not considered excessive. The qualified results are all considered acceptable for use in the risk assessment.

3.3.4 Laboratory Precision

Precision is a measure of the degree to which two or more measurements are in agreement and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions.

Precision for chemical parameters is expressed as a Relative Percent Difference (RPD), which is defined as the ratio of the difference to the mean for the two values being evaluated. RPDs, typically expressed as percentages, are used to evaluate both field and laboratory duplicate precision and are calculated as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \text{ x } 100$$

where	RPD	=	relative percent difference
	V1, V2	=	two results obtained by analyzing duplicate samples

The precision estimates obtained from duplicate field samples encompass the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory and field storage (as applicable), preparation for analysis, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, preparation for analysis, laboratory storage (if applicable), and analysis uncertainties.

Field duplicate precision noncompliances resulted in the qualification of several compounds in the PAH and PEST analytical fractions. The qualified field duplicate results are considered acceptable for use in risk assessment. Laboratory duplicate imprecision did not result in any qualification of the data.

3.3.5 Comparability

Comparability is defined as the confidence with which one data set can be compared with another (e.g., among sampling points and among sampling events). Comparability was achieved by using standardized sampling and analysis methods, as well as standardized data reporting formats. Comparability of laboratory measurements was achieved primarily through the use and documentation of standard sampling and analytical methods. Results were reported in units that ensured comparability with previous data. Comparability of laboratory measurements was assessed primarily through the use of QC samples and through adherence to the sampling and analysis plan.

3.3.6 Representativeness

Representativeness is an expression of the degree to which data accurately and precisely depict the actual characteristics of a population or environmental condition existing at the site. The use of standardized sampling, sample handling, sample analysis, and data reporting procedures were designed so that the final data would be accurate representations of actual site conditions.

It is believed that all reported data are adequately representative of site conditions and intended populations.

4.0 CONCLUSIONS

The data collected for the sediment characterization report are believed to adequately represent site conditions. The amount, type, and quality of data collected are sufficient to achieve the objectives of the sediment characterization report.

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
FD032812-01	COPPER	29.3	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
FD032812-01	MERCURY	0.0322	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
FD032812-01	ZINC	121	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
FD032812-01	BENZO(A)ANTHRACENE	0.216	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	BENZO(A)PYRENE	0.258	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	BENZO(B)FLUORANTHENE	0.261	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	BENZO(G,H,I)PERYLENE	0.176	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	BENZO(K)FLUORANTHENE	0.272	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	CHRYSENE	0.292	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	DIBENZO(A,H)ANTHRACENE	0.0215	MG/KG	UJ	G	FIELD DUPLICATE IMPRECISION
FD032812-01	FLUORANTHENE	0.673	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	FLUORENE	0.0215	MG/KG	UJ	G	FIELD DUPLICATE IMPRECISION
FD032812-01	INDENO(1,2,3-CD)PYRENE	0.176	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	PHENANTHRENE	0.364	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	PYRENE	0.513	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	ACENAPHTHENE	0.0215	MG/KG	UJ	G	FIELD DUPLICATE IMPRECISION
FD032812-01	ANTHRACENE	0.0688	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-01	4,4'-DDD	0.00288	MG/KG	J	CGU	CALIBRATION NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%
FD032812-01	4,4'-DDE	0.00998	MG/KG	J	EGU	LABORATORY CONROL SAMPLE RECOVERY NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%
FD032812-01	4,4'-DDT	0.0188	MG/KG	J	CGU	CALIBRATION NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%
FD032812-01	ENDOSULFAN II	0.0006	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
FD032812-02	CADMIUM	0.674	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
FD032812-02	ZINC	381	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
FD032812-02	TOTAL ORGANIC CARBON	20200	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE AND FIELD DUPLICATE IMPRECSION
FD032812-02	2-METHYLNAPHTHALENE	0.0453	MG/KG	UJ	G	FIELD DUPLICATE IMPRECISION
FD032812-02	ACENAPHTHENE	0.0933	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	ANTHRACENE	0.334	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	BENZO(A)ANTHRACENE	1.16	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	BENZO(A)PYRENE	1.32	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	BENZO(B)FLUORANTHENE	1.46	MG/KG	J	G	FIELD DUPLICATE IMPRECISION

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
FD032812-02	BENZO(G,H,I)PERYLENE	0.828	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	BENZO(K)FLUORANTHENE	1.34	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	CHRYSENE	1.57	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	DIBENZO(A,H)ANTHRACENE	0.267	MG/KG	J	DG	MATRIX SPIKE RECOVERY NONCOMPLIANCE AND FIELD DUPLICATE IMPRECSION
FD032812-02	FLUORANTHENE	3.7	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	FLUORENE	0.109	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	INDENO(1,2,3-CD)PYRENE	0.778	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	NAPHTHALENE	0.0453	MG/KG	UJ	G	FIELD DUPLICATE IMPRECISION
FD032812-02	PHENANTHRENE	1.93	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	PYRENE	2.91	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
FD032812-02	4,4'-DDD	0.0153	MG/KG	J	CU	CALIBRATION NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
FD032812-02	4,4'-DDE	0.0417	MG/KG	J	EU	LABORATORY CONROL SAMPLE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
FD032812-02	4,4'-DDT	0.00739	MG/KG	J	CGU	CALIBRATION NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%
FD032812-02	GAMMA-CHLORDANE	0.00217	MG/KG	J	GU	FIELD DUPLICATE IMPRECISION AND RPD BETWEEN COLUMNS >40%
NTC17PCSD53	CADMIUM	0.445	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD53	ZINC	384	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD53	TOTAL ORGANIC CARBON	22000	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD53	2-METHYLNAPHTHALENE	0.212	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	ACENAPHTHENE	1.41	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	ANTHRACENE	2.43	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	BENZO(A)ANTHRACENE	6.38	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	BENZO(A)PYRENE	5.69	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	BENZO(B)FLUORANTHENE	5.76	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	BENZO(G,H,I)PERYLENE	2.82	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	BENZO(K)FLUORANTHENE	6.15	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	CHRYSENE	7.07	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	DIBENZO(A,H)ANTHRACENE	0.933	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	FLUORANTHENE	18.4	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	FLUORENE	1.44	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	INDENO(1,2,3-CD)PYRENE	3.13	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	NAPHTHALENE	0.473	MG/KG	J	G	FIELD DUPLICATE IMPRECISION

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
NTC17PCSD53	PHENANTHRENE	13.4	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	PYRENE	14.5	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD53	4,4'-DDD	0.0138	MG/KG	J	CDU	CALIBRATION AND MATRIX SPIKE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
NTC17PCSD53	4,4'-DDE	0.0629	MG/KG	J	DEU	MATRIX SPIKE AND LABORATORY CONROL SAMPLE NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
NTC17PCSD53	4,4'-DDT	0.0311	MG/KG	J	CDGU	CALIBRATION AND MATRIX SPIKE NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%
NTC17PCSD53	ALDRIN	0.000481	MG/KG	UJ	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD53	ENDOSULFAN II	0.00187	MG/KG	J	CR	CALIBRATION AND SURROGATE RECOVERY NONCOMPLIANCE
NTC17PCSD53	GAMMA-CHLORDANE	0.00567	MG/KG	U	A	LABORATORY BLANK CONTAMINATION
NTC17PCSD54	COPPER	43.5	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD54	4,4'-DDD	0.0197	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD54	4,4'-DDE	0.0491	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD54	4,4'-DDT	0.00814	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD55	CADMIUM	0.398	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD55	COPPER	222	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD55	AROCLOR-1260	0.0352	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD55	4,4'-DDD	0.025	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD55	4,4'-DDE	0.036	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD55	4,4'-DDT	0.0342	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD55	ALPHA-CHLORDANE	0.00059	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD55	ENDOSULFAN II	0.00228	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD55	GAMMA-CHLORDANE	0.0006	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD56	CADMIUM	0.451	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD56	COPPER	62.2	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD56	ACENAPHTHENE	0.078	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
NTC17PCSD56	AROCLOR-1260	0.0586	MG/KG	J	CEP	CALIBRATION AND LABORAOTRY CONROL SAMPLE RECOVERY NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT AND RPD BETWEEN COLUMNS >40%
NTC17PCSD56	4,4'-DDD	0.236	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD56	4,4'-DDE	0.131	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD56	4,4'-DDT	0.0526	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD56	ENDOSULFAN II	0.00333	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD56	GAMMA-CHLORDANE	0.00666	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD57	COPPER	37.2	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD57	4,4'-DDD	0.00203	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD57	4,4'-DDE	0.00411	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD57	4,4'-DDT	0.00063	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD57	GAMMA-CHLORDANE	0.00329	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD58	MERCURY	0.0329	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD58	ZINC	107	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD58	ACENAPHTHENE	0.0215	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD58	DIBENZO(A,H)ANTHRACENE	0.0424	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD58	4,4'-DDD	0.00249	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD58	4,4'-DDT	0.00073	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD58	ALPHA-CHLORDANE	0.00029	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD58	ENDOSULFAN II	0.0004	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD58	GAMMA-CHLORDANE	0.00315	MG/KG	U	A	LABORATORY BLANK CONTAMINATION
NTC17PCSD59	COPPER	46.2	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD59	ANTHRACENE	0.0805	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD59	4,4'-DDD	0.00637	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD59	4,4'-DDE	0.0139	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD59	4,4'-DDT	0.00559	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD59	ENDOSULFAN II	0.00027	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD59	GAMMA-CHLORDANE	0.00081	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD60	CADMIUM	0.454	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
NTC17PCSD60	COPPER	89.6	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD60	NAPHTHALENE	0.0712	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD60	4,4'-DDD	0.0218	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD60	4,4'-DDE	0.0259	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD60	4,4'-DDT	0.0361	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD61	COPPER	28.5	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD61	MERCURY	0.0289	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD61	ZINC	85.5	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD61	TOTAL ORGANIC CARBON	11000	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD61	2-METHYLNAPHTHALENE	0.0408	MG/KG	J	DP	MATRIX SPIKE RECOVERY NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD61	ACENAPHTHENE	0.165	MG/KG	J	DG	MATRIX SPIKE RECOVERY NONCOMPLIANCE AND FIELD DUPLICATE IMPRECSION
NTC17PCSD61	ANTHRACENE	0.564	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	BENZO(A)ANTHRACENE	0.955	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	BENZO(A)PYRENE	0.933	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	BENZO(B)FLUORANTHENE	0.943	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	BENZO(G,H,I)PERYLENE	0.609	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	BENZO(K)FLUORANTHENE	0.919	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	CHRYSENE	1.04	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	DIBENZO(A,H)ANTHRACENE	0.252	MG/KG	J	DG	MATRIX SPIKE RECOVERY NONCOMPLIANCE AND FIELD DUPLICATE IMPRECSION
NTC17PCSD61	FLUORANTHENE	3.02	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	FLUORENE	0.237	MG/KG	J	DG	MATRIX SPIKE RECOVERY NONCOMPLIANCE AND FIELD DUPLICATE IMPRECSION
NTC17PCSD61	INDENO(1,2,3-CD)PYRENE	0.568	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	NAPHTHALENE	0.0306	MG/KG	J	DP	MATRIX SPIKE RECOVERY NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD61	PHENANTHRENE	2.39	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	PYRENE	2.22	MG/KG	J	G	FIELD DUPLICATE IMPRECISION
NTC17PCSD61	4,4'-DDD	0.00829	MG/KG	J	CDGU	CALIBRATION AND MATRIX SPIKE NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
NTC17PCSD61	4,4'-DDE	0.0179	MG/KG	J	EGU	LABORATORY CONROL SAMPLE RECOVERY NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%
NTC17PCSD61	4,4'-DDT	0.00456	MG/KG	J	CDGU	CALIBRATION AND MATRIX SPIKE NONCOMPLIANCE, FIELD DUPLICATE IMPRECISION, AND RPD BETWEEN COLUMNS >40%
NTC17PCSD61	ENDOSULFAN II	0.00046	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD61	GAMMA-CHLORDANE	0.00068	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD62	CADMIUM	0.789	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD62	COPPER	50.6	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD62	ACENAPHTHENE	0.0613	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD62	AROCLOR-1260	0.0263	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD62	4,4'-DDD	0.0427	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD62	4,4'-DDE	0.0366	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD62	4,4'-DDT	0.0432	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD62	ALDRIN	0.00055	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD62	ENDOSULFAN II	0.00023	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD62	GAMMA-CHLORDANE	0.00028	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD63	CADMIUM	0.39	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD63	COPPER	70.3	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD63	FLUORENE	0.0515	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD63	4,4'-DDD	0.0665	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD63	4,4'-DDE	0.112	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD63	4,4'-DDT	0.134	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD63	GAMMA-CHLORDANE	0.00185	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD64	COPPER	92.3	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD64	ACENAPHTHENE	0.0724	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD64	4,4'-DDD	0.0484	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD64	4,4'-DDE	0.0425	MG/KG	J	E	LABORATORY CONTROL SAMPLE RECOVERY NONCOMPLIANCE
NTC17PCSD64	4,4'-DDT	0.0662	MG/KG	J	C	CALIBRATION NONCOMPLIANCE

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
NTC17PCSD64	GAMMA-CHLORDANE	0.00046	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD65	ZINC	91.8	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD65	ANTHRACENE	0.0399	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD65	DIBENZO(A,H)ANTHRACENE	0.038	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD65	4,4'-DDD	0.00608	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD65	4,4'-DDT	0.0008	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD65	ALDRIN	0.00029	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD65	ENDOSULFAN II	0.00057	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD65	GAMMA-CHLORDANE	0.00318	MG/KG	U	A	LABORATORY BLANK CONTAMINATION
NTC17PCSD66	ZINC	144	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD66	ACENAPHTHENE	0.0622	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD66	4,4'-DDD	0.0234	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD66	4,4'-DDT	0.00469	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD66	GAMMA-CHLORDANE	0.00065	MG/KG	U	A	LABORATORY BLANK CONTAMINATION
NTC17PCSD67	ZINC	104	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD67	DIBENZO(A,H)ANTHRACENE	0.0922	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD67	4,4'-DDD	0.0147	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD67	4,4'-DDT	0.00915	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD67	ALDRIN	0.00051	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD67	GAMMA-CHLORDANE	0.00079	MG/KG	U	A	LABORATORY BLANK CONTAMINATION
NTC17PCSD68	CADMIUM	0.0866	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD68	ZINC	96	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD68	4,4'-DDD	0.0254	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD68	4,4'-DDT	0.00414	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD68	ALDRIN	0.00069	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD68	ENDOSULFAN II	0.00118	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD68	GAMMA-CHLORDANE	0.00192	MG/KG	U	A	LABORATORY BLANK CONTAMINATION
NTC17PCSD69	ZINC	146	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD69	ACENAPHTHENE	0.0604	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD69	FLUORENE	0.0872	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD69	4,4'-DDD	0.0063	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD69	4,4'-DDT	0.00794	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD69	ENDOSULFAN II	0.00165	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD69	GAMMA-CHLORDANE	0.00037	MG/KG	U	A	LABORATORY BLANK CONTAMINATION

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
NTC17PCSD70	CADMIUM	2.4	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD70	COPPER	390	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD70	ZINC	1580	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD70	AROCLOR-1260	0.0707	MG/KG	J	EU	LABORATORY CONROL SAMPLE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
NTC17PCSD70	4,4'-DDD	0.00079	MG/KG	J	CPRU	CALIBRATION AND SURROGATE RECOVERY NONCOMPLIANCE, UNCERTAINTY NEAR DETECTION LIMIT AND RPD BETWEEN COLUMNS >40%
NTC17PCSD70	4,4'-DDE	0.00221	MG/KG	J	EU	LABORATORY CONROL SAMPLE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
NTC17PCSD70	4,4'-DDT	0.000734	MG/KG	UJ	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD70	ENDOSULFAN II	0.00224	MG/KG	J	U	RPD BETWEEN COLUMNS >40%
NTC17PCSD70	GAMMA-CHLORDANE	0.00392	MG/KG	J	U	RPD BETWEEN COLUMNS >40%
NTC17PCSD71	CADMIUM	1.32	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD71	COPPER	251	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD71	ACENAPHTHENE	0.165	MG/KG	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD71	4,4'-DDD	0.00087	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD71	4,4'-DDE	0.00036	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD71	4,4'-DDT	0.00375	MG/KG	J	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD71	ALDRIN	0.00072	MG/KG	J	CP	CALIBRATION NONCOMPLIANCE AND UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD72	COPPER	94.3	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD72	ZINC	300	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD72	TOTAL ORGANIC CARBON	12900	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD72	AROCLOR-1260	0.025	MG/KG	J	EU	LABORATORY CONROL SAMPLE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
NTC17PCSD72	4,4'-DDD	0.00096	MG/KG	J	CRU	CALIBRATION AND SURROGATE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%

TABLE 1

SEDIMENT QUALIFIED DATA
SITE 17 - PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

SAMPLE ID	PARAMETER	SAMPLE RESULT	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
NTC17PCSD72	4,4'-DDE	0.00037	MG/KG	J	CEPRU	CALIBRATION, LABORAOTRY CONROL SAMPLE, AND SURROGATE RECOVERY NONCOMPLIANCE, UNCERTAINTY NEAR DETECTION LIMIT AND RPD BETWEEN COLUMNS >40%
NTC17PCSD72	4,4'-DDT	0.00414	MG/KG	J	CRU	CALIBRATION AND SURROGATE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
NTC17PCSD72	GAMMA-CHLORDANE	0.00301	MG/KG	J	U	RPD BETWEEN COLUMNS >40%
RB033012-01	BENZO(A)ANTHRACENE	0.0475	UG/L	J	P	UNCERTAINTY NEAR DETECTION LIMIT
RB033012-01	FLUORANTHENE	0.112	UG/L	J	P	UNCERTAINTY NEAR DETECTION LIMIT
RB033012-01	PHENANTHRENE	0.102	UG/L	J	P	UNCERTAINTY NEAR DETECTION LIMIT
RB033012-01	PYRENE	0.0813	UG/L	J	P	UNCERTAINTY NEAR DETECTION LIMIT
NTC17PCSD50	MERCURY	0.257	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE
NTC17PCSD50	AROCLOR-1260	0.334	MG/KG	J	R	SURROGATE RECOVERY NONCOMPLIANCE
NTC17PCSD50	4,4'-DDD	0.00173	MG/KG	UJ	C	CALIBRATION NONCOMPLIANCE
NTC17PCSD50	4,4'-DDE	0.00335	MG/KG	J	CEPRU	CALIBRATION, LABORATORY CONROL SAMPLE AND SURROGATE RECOVERY NONCOMPLIANCE, UNCERTAINTY NEAR DETECTION LIMIT AND RPD BETWEEN COLUMNS >40%
NTC17PCSD50	4,4'-DDT	0.00793	MG/KG	J	RU	SURROGATE RECOVERY NONCOMPLIANCE AND RPD BETWEEN COLUMNS >40%
NTC17PCSD50	ENDOSULFAN II	0.00473	MG/KG	J	R	SURROGATE RECOVERY NONCOMPLIANCE
NTC17PCSD50	GAMMA-CHLORDANE	0.00961	MG/KG	J	R	SURROGATE RECOVERY NONCOMPLIANCE
NTC17PCSD51-52	MERCURY	0.892	MG/KG	J	D	MATRIX SPIKE RECOVERY NONCOMPLIANCE

Notes:
Field duplicate pairs are FD032812-01/NTC17PCSD61 and FD032812-02/NTC17PCSD53.

APPENDIX D

SAMPLE SELECTION FOR TOXICITY TESTING

Selection of Samples for Toxicity Testing
Site 17 – Pettibone Creek
Naval Station Great Lakes
Great Lakes, Illinois

This memorandum presents the samples that are proposed for selection of toxicity testing at Site 17 - Pettibone Creek. The procedures for conducting the tests are presented in the Sampling and Analysis Plan (SAP). In summary, 10-day tests using *Hyalella Azteca* will be conducted on the selected samples with survival and growth as the endpoints. The tests will be conducted in accordance with the current ASTM Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates (E1706 – 05).

Figure 1 shows the locations of the 2011 sediment samples in Pettibone Creek, while Table 1 presents the chemical data and some selected benthic community metrics for the samples where chemical data and the benthic community data were collected. In accordance with the SAP, sediment from locations NTCSDPCSD55 through SD57 and SD70 through SD72 were only collected for chemical analysis, not for toxicity testing, so the results are not included in Table 1.

Table 1 also presents the chemical concentrations in each sample compared to the Threshold Effects Concentrations (TECs) and the Probably Effects Concentrations (PECs), and indicates which samples are recommended for toxicity testing. Figures 2 through 5 present plots of the chemical data (copper, lead, zinc, and total PAHs, respectively) for the samples that are proposed for toxicity testing.

Based on the results in Table 1, samples were selected to obtain a range of concentrations for copper, lead, zinc, and total PAHs because the other parameters are unlikely to cause toxicity or elicit a dose response relationship based on their relatively low concentrations. In fact, based on the chemical concentrations with respect to the PEC (or similar value for PAHs), it is more likely that dose-response relationships will only be determined for zinc and PAHs (if toxicity is observed at all), based on their higher concentrations with respect to their sediment benchmarks.

The range of sample concentrations for the samples selected for toxicity testing can be seen on Figures 2 through 5. From these figures, it can be seen that the selected samples represents a concentration gradient from low to high, based on the results in the collected samples at the site.

Table 1
Selection of Sediment Samples for Toxicity Testing Based on Chemical Concentrations and Benthic Community Health Data
Site 17 - Pettibone Creek
Naval Station Great Lakes
Great Lakes, Illinois

Sample Location	Site/ Reference	Chemical Concentration (mg/kg)						Total Organic Carbon (mg/kg)	Benthic Community Health Data				Rationale
		Copper	Lead	Mercury	Zinc	Total PAHs	Total DDT		mIBI	Total Taxa	EPT Pct Score	Density	
Screening Level (TEC)		**31.6**	**35.8**	**0.18**	**121**	**4[1]**	**0.001[2]**	**NA**	**NA**	**NA**	**NA**	**NA**	
Higher Effects Level (PEC)		**149**	**128**	**1.06**	**459**	**35[1]**	**0.572**	**NA**	**NA**	**NA**	**NA**	**NA**	
Site Samples													
NTC17PCSD53	Site	68.3	96.7	0.17	384	90.2	0.108	22000	14	21	0	1806	High PAHs and metals
NTC17PCSD54	Site	43.5	30	0.124	131	34.7	0.077	18900	19.4	22	0.49	2085	High PAHs and moderate-low metals
NTC17PCSD58	Site, tributary	34.7	29	0.0329	107	3.54	0.010	11900	10.4	13	0	1389	
NTC17PCSD59	Site	46.2	29.6	0.0652	141	5.11	0.026	11600	12.6	20	2.36	2419	
NTC17PCSD60	Site	89.6	56.8	0.132	329	25.0	0.084	36700	17.2	25	7.36	837	Moderate PAHs and high metals
NTC17PCSD61	Site	28.5	15.4	0.0289	85.5	14.9	0.031	11000	21.3	25	4.5	984	Low-Moderate PAHs and low metals
NTC17PCSD62	Site	50.6	33.7	0.171	56.7	10.81	0.123	24100	20.8	28	0.52	1157	
NTC17PCSD63	Site	70.3	102	0.157	299	9.18	0.313	10200	23.5	30	0.9	2595	Low-Moderate PAHs and high metals
NTC17PCSD64	Site	92.3	64.8	0.22	357	15.0	0.157	22100	20.2	24	2.81	5569	Moderate PAHs and high metals
Reference Samples													
NTC17PCSD65	Reference	26.6	24	0.0654	91.8	2.35	0.013	13900	21.3	21	4.83	3980	
NTC17PCSD66	Reference	36.8	33.8	0.169	144	9.10	0.054	18100	24.1	29	4.67	2565	Reference (low PAHs and metals)
NTC17PCSD67	Reference	31	25.8	0.632	104	8.05	0.046	29000	30.3	31	4.9	2741	
NTC17PCSD68	Reference	27.4	24.6	0.203	96	2.75	0.062	21500	30.5	30	1.01	4388	Reference (low PAHs and metals)
NTC17PCSD69	Reference, tributary	40.6	53.6	0.061	146	16.2	0.028	33100	13.3	17	4.1	2756	

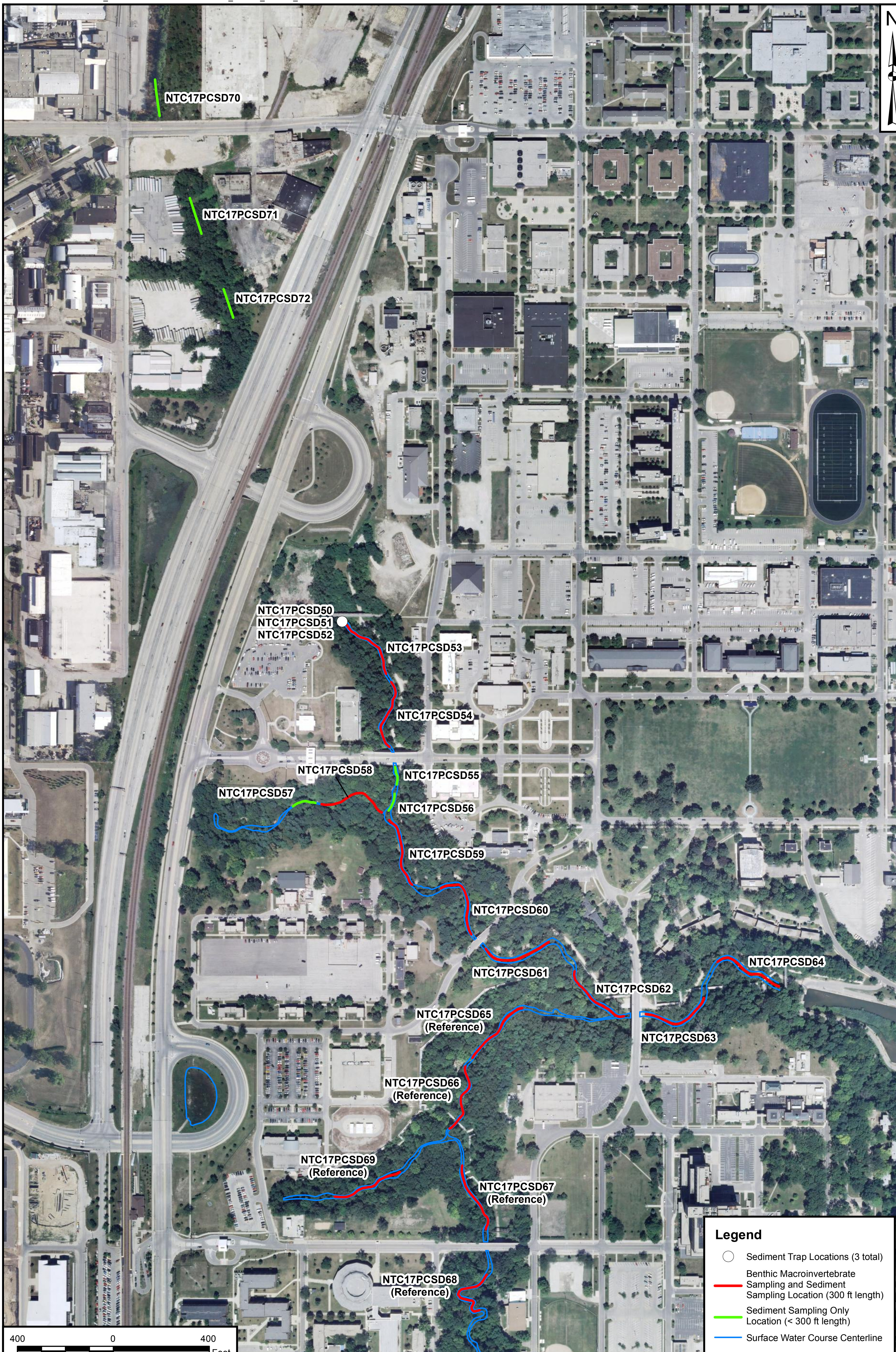
Notes:

TEC - Threshold Effects Concentration (unless otherwise noted)
PEC - Probable Effects Concentration (unless otherwise noted)

Sample concentration exceeds the TEC (or other similar value)
Sample concentration exceeds the PEC (or other similar value)
Sample selected for toxicity testing

1 - Illinois EPA Tier 1 – Draft Illinois EPA Tiered Approach for Evaluation and Remediation of Petroleum Product Releases to Sediments (Illinois EPA, September 2000)
2 - Baseline sediment screening objective calculated by Illinois EPA using unpublished derived water quality criteria (Brian Conrath, personal communication, February 05, 2002). Value is for 4,4'-DDT.

PGH P:\GIS\GREATLAKES_NS\MAPDOCS\MXD\PETTIBONE_CREEK_LINEAR_REACHES.MXD 03/06/12 JEE



DRAWN BY	DATE
J. ENGLISH	02/01/12
CHECKED BY	DATE
L. GANSER	03/05/12
REVISED BY	DATE
J. ENGLISH	03/06/12
SCALE AS NOTED	

NAVFAC

PROPOSED SAMPLING LOCATIONS
PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NUMBER	CTO NUMBER
1021	474
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO. FIGURE 1	REV 0

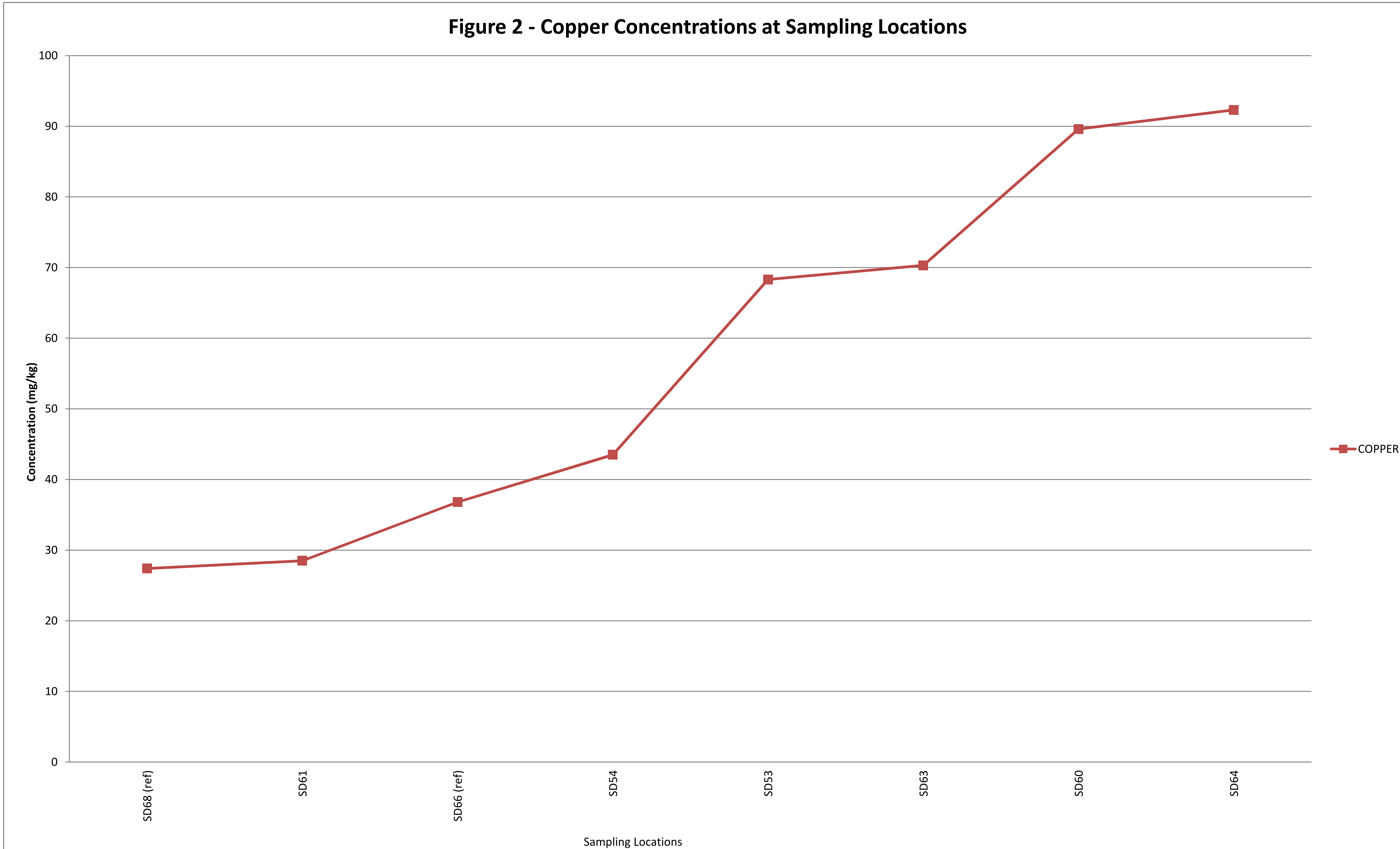


Figure 2 - Copper Concentrations at Sampling Locations
Concentration (mg/kg)
100
90
80
70
60
50
40
30
20
10
0
SD68 (ref)
SD61
SD66 (ref)
SD54
SD53
SD63
SD60
SD64
Sampling Locations
COPPER

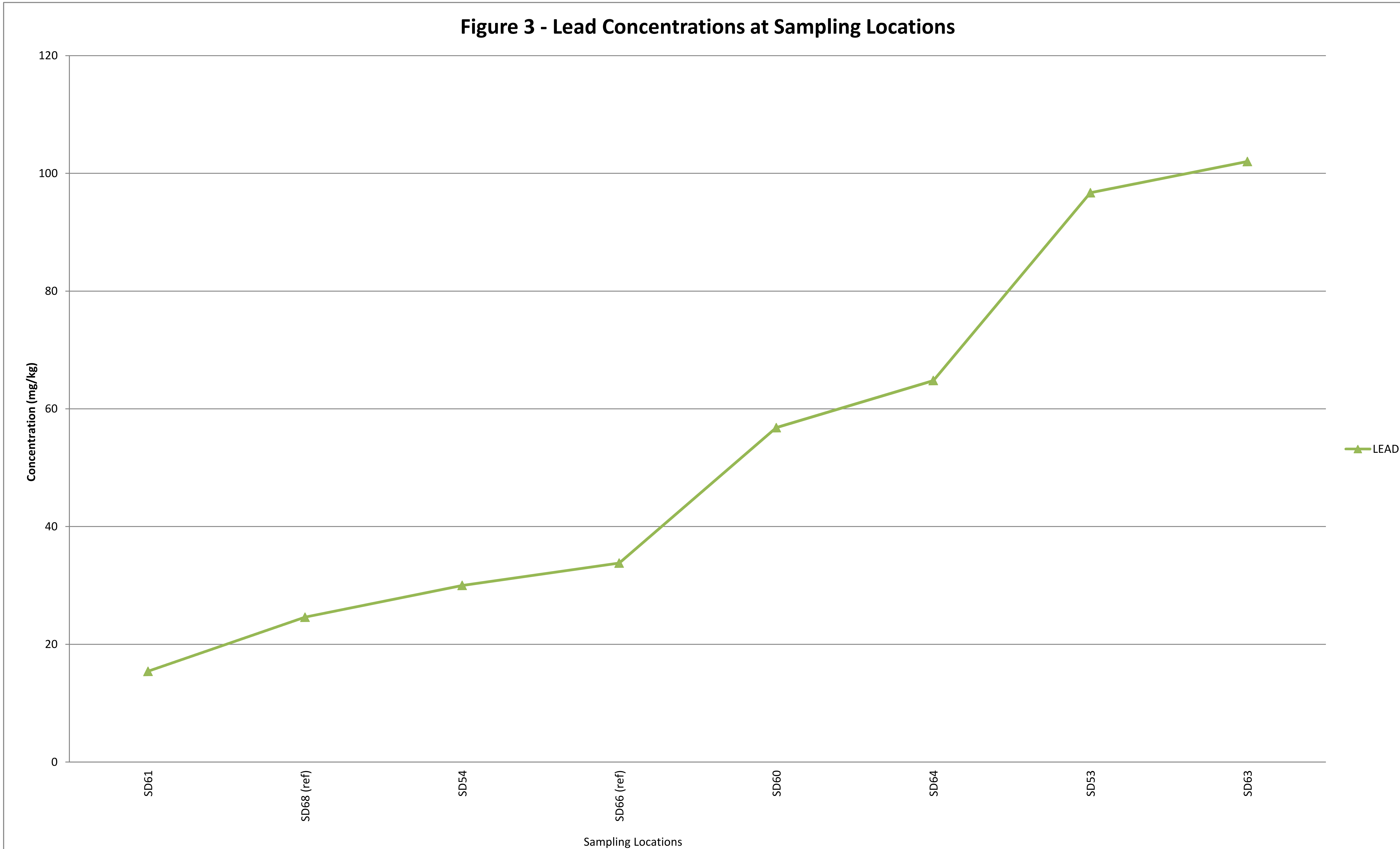


Figure 3 - Lead Concentrations at Sampling Locations
Concentration (mg/kg)
120
100
80
60
40
20
0
SD61
SD68 (ref)
SD54
SD66 (ref)
SD60
SD64
SD53
SD63
Sampling Locations
LEAD

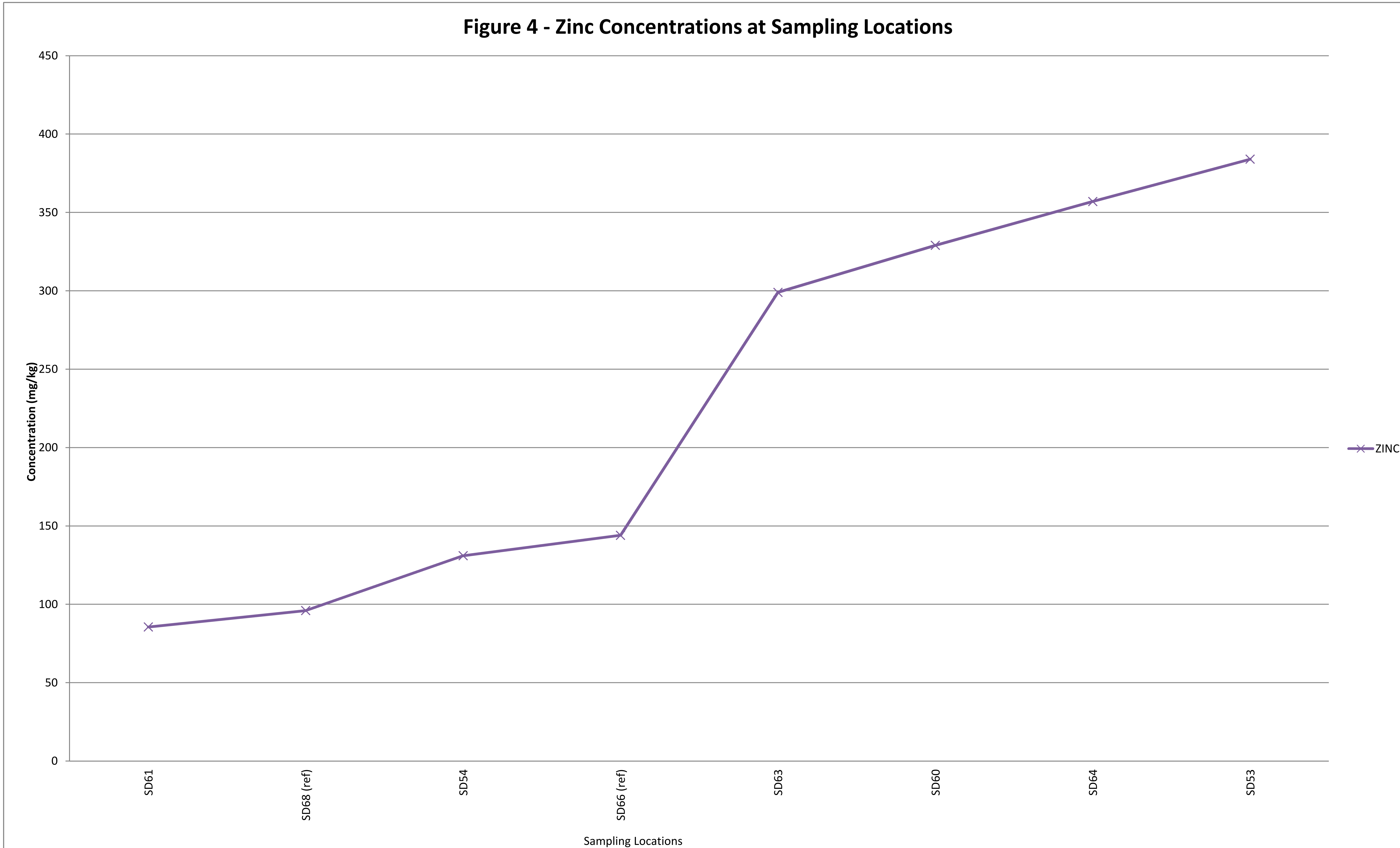


Figure 4 - Zinc Concentrations at Sampling Locations
Concentration (mg/kg)
450
400
350
300
250
200
150
100
50
0
SD61
SD68 (ref)
SD54
SD66 (ref)
SD63
SD60
SD64
SD53
Sampling Locations
ZINC

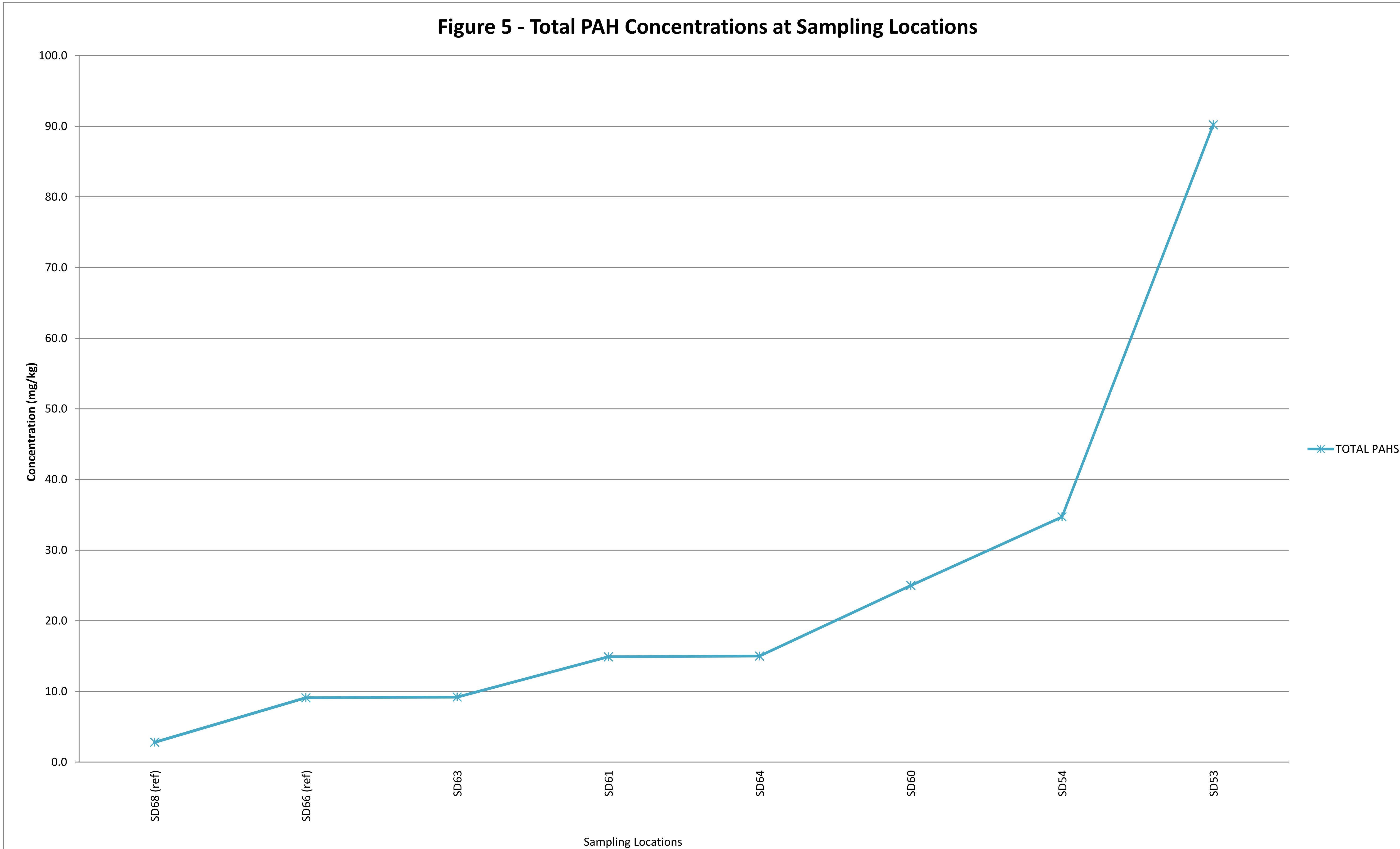


Figure 5 - Total PAH Concentrations at Sampling Locations
Concentration (mg/kg)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
SD68 (ref)
SD66 (ref)
SD63
SD61
SD64
SD60
SD54
SD53
Sampling Locations
TOTAL PAHS

APPENDIX E

TOXICITY TESTING REPORT AND TOXICITY CONCENTRATION PLOTS

TOXICITY TESTING REPORT

Results of 10 day Sediment Toxicity Tests with *Hyalella azteca* for Naval Station Great Lakes

Submitted to:
Mr. Robert Davis
Tetra Tech, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, PA 15220
Phone: 412-921-7251

Prepared by:
Tetra Tech, Inc.
400 Red Brook Boulevard, Suite 200
Owings Mills, Maryland 21117

May 30, 2012

SUMMARY

CLIENT: Tetra Tech NUS

TEST FACILITY: Naval Station Great Lakes

TEST MATERIAL: Sediment from 8 sites, plus control

DATE(S) COLLECTED: 28 – 30 March 2012

DATE(S) RECEIVED: 31 March 2012

COLLECTED BY: Chad Barbour, Tetra Tech, Inc.

CONTROL/DILUTION WATER: Moderately Hard Reconstituted Water

TYPE OF TEST(S): 10-Day Sediment Toxicity using *Hyalella azteca*

TEST DATE(S): 15 – 25 May, 2012

TEST RESULTS:

TABLE 1. SUMMARY OF TEST RESULTS

Site	Mean % Survival	Mean Weight of Survivors (mg)	Mean Individual Weight based on 10 Organisms per Chamber (mg)
Control	97.5	0.08925	0.0875
NTC17PCSD53	88.8	0.1160	0.1025
NTC17PCSD54	92.5	0.1286	0.1175
NTC17PCSD60	86.3	0.1069	0.0912
NTC17PCSD61	93.8	0.0955	0.0875
NTC17PCSD63	93.8	0.1281	0.1200
NTC17PCSD64	82.5	0.1030	0.0825
NTC17PCSD66*	95	0.1606	0.1500
NTC17PCSD68*	87.5	0.1240	0.1088

* Reference Site

MATERIALS AND METHODS

TEST MATERIAL

One gallon of sediment for each of 14 sites was collected by Tetra Tech personnel. The samples were transported in one gallon plastic ziploc bags on ice to Tetra Tech's Biological Research Facility. Upon arrival, the sample identification, collection date and time were recorded on the sample chain-of-custody sheet (see Appendix A Chain-of-Custody). Temperature of sediment was recorded upon arrival by measuring the temperature blank (water) packed with sediment. Temperature in all blanks was < 4° C and was recorded on the chain-of-custody sheet. Of the 14 sites sampled, only 8 were selected for toxicity testing.

CONTROL/DILUTION WATER

The control/dilution water used for the *Hyalella azteca* 10-day sediment toxicity test was moderately hard reconstituted water with a hardness of 96 mg/L as $CaCO_3$ and an alkalinity of 48 mg/L as $CaCO_3$.

TEST ORGANISMS/AGE

Hyalella azteca, 12 to 14 days old (all within a 24 hour range in age), were obtained from ABS (Aquatic BioSystems Inc.) and Chesapeake Cultures. All organisms appeared healthy and disease free.

TEST METHODS

Samples were thoroughly homogenized in the lab in a stainless steel bowl with a Teflon spoon. During homogenization, the sediments were inspected for indigenous organisms and if found they were removed.

U.S. Environmental Protection Agency. 2000. "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates." 2nd edition. EPA/600/R-99/064. U.S. EPA, ORD, Duluth, MN.

ASTM. 2006. Standard test methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. E1706-05. In Annual Book of ASTM Standards, Vol. 11.06, Philadelphia, PA.

Tetra Tech Standard Operating Procedure TT-BRF/TX-SOP-O-017. 10-day Sediment Toxicity Test Using *Hyallela azteca*. Created February 3, 2012. (Internal document prepared by Tetra Tech, Inc.)

TEST CONDITIONS

A summary of the test conditions for the *H. azteca* 10-day sediment toxicity test is on page 4.

AERATION OF TEST

Due to dissolved oxygen levels below 2.5 mg/L (see Table 3), slow aeration was provided on May 24, 2012 prior to test organisms being loaded into test chambers on May 25, 2012. Dissolved oxygen levels were sufficient after the addition of aeration.

MODIFICATIONS TO PROTOCOLS

None.

COMMENTS CONCERNING TEST

Avoidance of the sediment by test organisms was observed in some site test containers, particularly sites NTC17PCSD60 and NTC17PCSD64. Organisms were inadvertently removed from test chambers during the renewal of the control, NTC17PCSD60, NTC17PCSD64, NTC17PCSD63, NTC17PCSD54, and NTC17PCSD66. The organisms were reintroduced to replicates of the same sample that they were removed from , as noted on the data sheets, but it was unknown to which replicate they were removed.

The avoidance of sediment by Hyalella azteca has been shown to be common in sediments with a very high sand content or in tests that are not fed (Ingersoll et al., 2000). The organisms were fed daily during the tests, so that would not be the reason. Although grain size analysis was not conducted, if a grain size analysis was conducted, Table 8 in Appendix B presents the percent particle size distribution for each sampling station determined by systematic random, 100-particle modified Wolman pebble count. Based on the results in the table, the grain size distribution at sites NTC17PCSD60 and NTC17PCSD64 were not remarkably different that the other sites, except that the percent of silt/clay was on the lower side.

Also, Whiteman et al. (1996) found that the 10-d LC50 for ammonia in sediment exposures with H. azteca was not reached until pore-water concentrations were nearly tenfold the water-only LB50 (at which time the ammonia concentration in the overlying water was equal to the water-only LC50). The authors attributed this discrepancy to avoidance of the sediment by H. Azteca. As seen in Appendix E, the maximum ammonia concentrations in the samples from NTC17PCSD60 and NTC17PCSD64 were elevated compared to the other stations, which may have been partially responsible for the avoidance of the sediment.

Ingersoll CG, Ivey CD, Brunson EL, Hardesty DK, and Kemble, NE. 2000. Evaluation of Toxicity: Whole Sediment Versus Overlying-Water Exposures with Amphipod Hyalella azteca. Environ. Toxicol. Chem 19: 2906-2910.

Whiteman FW, Ankley GT, Dahl MD, Rau DM, and Balcer MD. 1996. Evaluation of interstitial water as a route of exposure to ammonia in sediment tests with macroinvertebrates. Environ. Toxicol. Chem 15: 794-801.

TABLE 2. Summary of Test Conditions for *Hyalella azteca* 10-day Whole Sediment Toxicity Test.

PARAMETER		CONDITIONS
1.	Test type	Whole-sediment toxicity test with renewal of overlying water
2.	Test duration	10-D
3.	Temperature	23°C ± 1°C daily mean temperature, 23 ± 3°C instantaneous temperature
4.	Light quality	Wide-spectrum fluorescent lights
5.	Light intensity	~ 500-1000 lux
6.	Photoperiod	16h light, 8h darkness
7.	Test chamber size	500 mL high-form lipless beaker
8.	Sediment volume	100 mL
9.	Overlying water volume	175 mL
10.	Renewal of overlying water	2 volume additions/d (i.e., one volume addition every 12 h)
11.	Age of test organisms:	12 - 14 days old
12.	No. organisms per test chamber	10
13.	No. replicate chambers per sample	8
14.	No. organisms per sample	80
15.	Feeding regime	Fed 1.0 mL YTC daily to each test chamber
16.	Test chamber cleaning	If screens become clogged during a test, gently brush the outside of the screen
17.	Aeration	Slow aeration was provided as per USEPA guidelines.
18.	Overlying water	Moderately Hard Reconstituted Water
19.	Overlying water quality	Ammonia, pH, DO, and temperature twice daily on day -2, -1 and Day 0; Hardness, alkalinity, conductivity, pH and ammonia at the beginning and end of a test. Temperature and dissolved oxygen daily during the test.
20.	Endpoint	Survival and growth (dry weight)
21.	Sampling and sample holding requirements	Samples used within 8 weeks of receipt. Samples stored in the dark at 4°C in sealed containers with no air space.
22.	Sample volume required	one gallon
23.	Test acceptability	Minimum mean control survival of 80% and measurable growth of test organisms in the control sediment. Performance-based criteria specifications outlined in Tetra Tech SOP TT-BRF/TX-SOP-O-017.

RESULTS

OVERLYING WATER PHYSICAL/CHEMICAL RESULTS

The physical/chemical results of the overlying water including: alkalinity and hardness (as mg $CaCO_3$), ammonia, dissolved oxygen, pH, temperature, and conductivity, are summarized in Table 3. See Appendix B Laboratory Bench Sheets for all physicochemical data.

HYALELLA AZTECA RESULTS

Hyalella azteca survival in site sediments ranged between 82.5% (NTC17PCSD64) to 95.0% (NTC17PCSD66). There was no significant difference in the survival of any site with respect to the controls or either reference location (NTC17PCSD66 or NTC17PCSD68). The results of the statistical analyses, along with significance levels, are included in Table C-1 in Appendix C Statistical Analyses.

Mean weight of survivors in all test sites was not significantly different from that in reference site NTC17PCSD68 (Table C-2; Statistics Appendix, ANOVA, Duncan Multiple Range Test, $p<0.05$). However, four out of 8 test sites (NTC17PCSD53; NTC17PCSD60; NTCPCSD61; and NTC17PCSD64) had significantly lower survivor weights when compared to reference site NTC17PCSD66 (Table C-2; Statistics Appendix, ANOVA, Duncan Multiple Range Test, $p<0.05$). The results of the statistical analysis of the mean weight of survivors, along with significance levels, are included in Table C-2 in Appendix C Statistical Analysis.

Biomass or the weight of the survivors divided by the original number of organisms placed in the test chambers yielded similar results as the survival weight analysis. In five out of the eight tests sites (NTC17PCSD53; NTC17PCSD60; NTC17PCSD61; NTC17PCSD64; and NTC17PCSD68), biomass was significantly lower than that in reference site NTC17PCSD66 (Table C-3; Statistics Appendix, ANOVA, Duncan Multiple Range Test, $p<0.05$). Only the other reference site, NTC17PCSD66, yielded a significant difference in comparison with reference site NTC17PCSD68 (Table C-3; Statistics Appendix, ANOVA, Duncan Multiple Range Test, $p<0.05$). The results of the statistical analysis, along with significance levels, are included in Table C-3 in Appendix C Statistical Analysis.

COMMENTS CONCERNING TEST RESULTS

Test acceptability criteria were met for *H. azteca* for this test as evidenced by >80% survival in the controls and measurable growth. Average initial weight of *H. azteca* was 0.066 mg/individual (see Appendix B Laboratory Bench Sheets) and average final weight of the controls was 0.089 mg/individual.

QUALITY ASSURANCE/QUALITY CONTROL

Reference toxicant test data are included in Appendix D Quality Assurance/Quality Control.

TABLE 3. SUMMARY OF WATER QUALITY AND TEST DATA FOR *Hyalella azteca* 10-DAY SEDIMENT TOXICITY TEST

Client: Tetra Tech NUS		
Experiment ID: Tt01291 – Tt01299	Start Test	5-15-12
Sample Tested: NTC, Great Lakes, IL	End Test	5-25-12

RESULTS
(include water quality before organisms were loaded)

WATER CHEMISTRY ANALYSIS (RANGE)							
Site	Cond. (µmhos)	D.O. (mg/L)	pH	Temp. (°C) Instantaneous	Alkalinity (mg/L as $CaCO_3$))	Hardness (mg/L as $CaCO_3$))	Ammonia (mg/L)
Control	337 – 370	6.0 – 9.0	6.3 – 7.1	22.5 – 23.2	34 – 54	80 – 98	0.04 – 0.35
NTC17PCSD53	435 – 462	5.3 – 8.7	6.2 – 7.2	22.5 – 23.2	84 – 86	128 – 130	0.03 – 0.16
NTC17PCSD54	442 – 499	5.0 – 8.9	6.9 – 7.6	22.5 – 24.3	90 – 96	124 – 130	001 – 0.15
NTC17PCSD60	512 – 575	2.3 – 8.4	6.4 – 7.6	22.5 – 24.3	124 – 132	148 – 158	0.1 – 3.6
NTC17PCSD61	428 – 449	4.1 – 9.0	6.8 – 7.4	22.5 – 24.3	62 – 84	144 – 148	ND – 0.19
NTC17PCSD63	439 – 476	3.6 – 8.6	6.9 – 7.5	22.5 – 24.3	80 – 98	116 – 154	0.1 – 0.53
NTC17PCSD64	494 – 543	1.7 – 8.6	6.6 – 7.5	22.5 – 24.3	110 – 118	150 – 160	0.1 – 4.1
NTC17PCSD66*	468 – 471	3.9 – 8.8	6.6 – 7.2	22.5 – 23.2	100 – 116	120 – 162	0.04 – 0.50
NTC17PCSD68*	509 – 547	2.1 – 8.8	6.7 – 7.3	22.5 – 24.3	116 – 142	132 – 160	0.1 – 2.1

* Reference Site

A. CHAIN OF CUSTODY

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER № 027881 | PAGE 1 OF 1

PROJECT NO: 1126-01021	FACILITY: GREAT LAKES	PROJECT MANAGER: ROBERT DAVIS	PHONE NUMBER: 412 921 7090	LABORATORY NAME AND CONTACT: MARCUS BOWERSOX, 410-356-8993
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER: KEITH SIMPSON	PHONE NUMBER: 412 352 2264	ADDRESS: 400 RED BROOK BLVD. SUITE 200
		CARRIER/WAYBILL NUMBER		CITY, STATE: OWINGS MILLS, MD 21117

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☒ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)
PRESERVATIVE USED
TYPE OF ANALYSIS

SITE 17
MARCH 2012

DATE YEAR 2012	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (~~FT~~) CM	BOTTOM DEPTH (~~FT~~) CM	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	TOXICITY							COMMENTS
3/28	1550	NTC17PCSD53		0	4	SD	C	1	✓							
3/28	1505	NTC17PCSD54				SD	C	1	✓							
3/28	1410	NTC17PCSD59				SD	C	1	✓							
3/28	1000	NTC17PCSD60				SD	C	1	✓							
3/28	0810	NTC17PCSD ~~601~~ 6CD				SD	C	1	✓							
3/27	1645	NTC17PCSD62				SD	C	1	✓							
3/27	1315	NTC17PCSD63				SD	C	1	✓							
3/27	1510	NTC17PCSD64				SD	C	1	✓							
3/29	0830	NTC17PCSD58				SD	C	1	✓							
3/29	1132	NTC17PCSD65				SD	C	1	✓							
3/29	1210	NTC17PCSD66				SD	C	1	✓							
3/29	1515	NTC17PCSD67				SD	C	1	✓							
3/29	1540	NTC17PCSD68				SD	C	1	✓							

1. RELINQUISHED BY	DATE 3.30.12	TIME 0955	1. RECEIVED BY FEDEX	DATE 3.30.12	TIME 0955
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE 4/2/12	TIME 0800
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R

B. LABORATORY BENCH SHEETS

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: TT01291
Laboratory ID: TT
Sediment Load Date/Time: 5/13/12 0915

Sample ID: Control
Client/Project: NUS-Pattibone
Organism Load Date/Time: 5/15/12 1029

Organism Batch #: 0109
Sediment Volume (mL): 100
Test End Date/Time: 5/25/12 930

Organism Age: 12-14d
Water Volume (mL): 175
Corresponding Control Test #: —

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10*	10	10	10	10	10	10	10	BS	1029	97.5
10	11	10	9	10	10	10	9	9	PS	0900	

Day	Renewal Water Batch ID & Time: Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	PS	0915	lab00395	PS	1400					0.10	0.12	7.1	6.3	23.2	23.2	8.0	6.1	BS	PS	09??	1430
-1	lab00395	PS	0930	lab00395	PS	1430					0.09	0.07	6.3	6.4	22.5	22.5	6.1	6.0	PS	PS	0943	1430
0	lab00395	PS	0900	lab00395*	PS	1540	284	34	80	337	0.04	0.04	6.3	6.7	23.0	23.0	8.4	6.2	PS	PS	1030	1540
1	lab00395	PS	0930	lab00395	BS	1535	284								22.5		7.8		PS		0930	
2	lab00395	BS	0920	lab00395	BS	1530	284								22.7		8.8		BS		0920	
3	lab00395	BS	0830	lab00395	BS	1540	282								23.1		8.4		BS		0950	
4	lab00395	PS	0900	lab00395	BS	1550	282								23.1		7.9		PS		1000	
5	lab00395	PS	0900	lab00395	BS	1500	282								22.9		7.4		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								22.8		7.6		PS		0945	
7	lab00395	BS	0920	lab00395	BS	1510	282								22.6		8.2		BS		0925	
8	lab00395	PS	0930	lab00395	PS	1615	282								22.6		8.6		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	54	98	370	0.35		7.1		22.6		9.0		PS		1110	
10															22.7		7.6		PS		1505	

*One organism accidentally removed during renewal from unknown rep, replaced in A PS 5/15/12

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: [illegible]

Weight Data for *Hyallela azteca* Growth

Test ID: T+01291 | Start Date: 5/15/12 | End Date: 5/25/12
Drying Temp: 100°C | Drying Time: 6 hrs. | Weighing Date: 5/29/12
Analyst: NRS | Client: TE NMS

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1951	1.1960	0.9	11	0.082	
	B	1.1804	1.1811	0.7	10	0.07	
	C	1.1853	1.1865	1.2	9	0.13	
	D	1.1825	1.1838	1.3	10	0.13	
	E	1.1842	1.1847	0.5	10	0.05	
	F	1.1838	1.1851	1.3	10	0.13	
	G	1.1869	1.1876	0.7	9	0.078	
	H	1.2018	1.2022	0.4	9	0.044	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

Avg. = 0.089

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: TT01292
Sample ID: NTC17RCSP53
Organism Batch #: 0109
Organism Age: 12-14d

Laboratory ID: TT
Client/Project: NWS-Pah Vaw
Sediment Volume (mL): 100
Water Volume (mL): 175

Sediment Load Date/Time: 5/13/12 0930
Organism Load Date/Time: 5/15/12 1031
Test End Date/Time: 5/25/12 0945
Corresponding Control Test #: TT01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival ($\frac{\#\ Surviving}{\#\ Exposed} \times 100$)
0	10	10	10	10	10	10	10	10	PS	1031	88.8
10	9	8	10	7	9	8	10	10	BS	0950	

Day	Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	PS	0930	lab00395	PS	1400					0.10	0.10	7.1	6.2	23.2	23.2	8.0	5.8	BS	PS	0900	1430
-1	lab00395	PS	0930	lab00395	PS	1430					0.13	0.11	6.4	6.5	22.5	22.5	5.3	6.0	PS	PS	0943	1430
0	lab00395	PS	0900	lab00395	PS	1540	284	84	130	462	0.07	0.03	6.4	6.7	23.0	23.0	6.0	6.3	PS	PS	1030	1540
1	lab00395	PS	0930	lab00395	BS	1535	284								22.5		8.0		PS		0930	
2	lab00395	BS	0920	lab00395	BS	1530	284								22.7		8.7		BS		0920	
3	lab00395	BS	0930	lab00395	BS	1540	282								23.1		8.3		BS		0950	
4	lab00395	PS	0900	lab00395	BS	1550	282								23.1		8.2		PS		1000	
5	lab00395	PS	0900	lab00395	BS	1500	282								22.9		7.6		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								22.8		8.2		PS		0945	
7	lab00395	BS	0920	lab00395	BS	1510	282								22.6		8.3		BS		0925	
8	lab00395	PS	0930	lab00395	PS	1615	282								22.6		8.6		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	80	128	435	0.16		7.2		22.6		8.7		PS		1110	
10															22.7		7.9		PS		1505	

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: MOB

2010

Weight Data for *Hyallela azteca* Growth

Test ID: TTO1292
Start Date: 5/15/12
End Date: 5/25/12
Drying Temp: 100°C
Drying Time: 6 h
Weighing Date: 5/29/12
Analyst: NSB
Client: TE NUS

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.2042	1.2050	0.8	9	0.089	
	B	1.1942	1.1951	0.8	8	0.10	
	C	1.2031	1.2040	0.9	10	0.09	
	D	1.2152	1.2158	0.6	7	0.086	
	E	1.1997	1.2009	1.2	9	0.133	
	F	1.1958	1.1973	1.5	8	0.19	
	G	1.1820	1.1830	1.0	10	0.10	
	H	1.1683	1.1697	1.4	10	0.14	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

Avg. = 0.116

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved NSB

2012

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: TT01293

Sample ID: NCT17PCSD60

Organism Batch #: 0109

Organism Age: 12-14d

Laboratory ID: TT

Client/Project: NW-Pathlow

Sediment Volume (mL): 100

Water Volume (mL): 175

Sediment Load Date/Time: 5/13/12 0835

Organism Load Date/Time: 5/15/12 1132

Test End Date/Time: 5/25/12 1030

Corresponding Control Test #: TT01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10	10	10	10*	10	10	10	10	BS	1132	
10	9	10	9	12	6	8†	6	9	BS	1035	86.3

Day	Renewal Water Batch ID & Time: Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	BS	0935	lab00395	PS	1400					0.10	2.8	7.1	6.4	23.2	23.2	8.0	3.5	BS	PS	0900	1430
-1	lab00395	PS	0930	lab00395	BS	1430					3.6	2.7	6.7	7.2	22.5	22.5	2.3	5.6	PS	PS	0845	1430
0	lab00395	PS	0900	lab00395*	PS	1540	~~1123~~	132	148	575	3.3	~~7.4~~ 2.0	7.6	6.7	22.5	22.5	5.0	5.5	PS	PS	1030	1540
1	lab00395	PS	0930	lab00395	BS	1535	284								22.6		6.3		PS		0930	
2	lab00395	BS	0920	lab00395	BS	1530	284								23.2		6.8		BS		0920	
3	lab00395	BS	0930	lab00395	BS	1590	282								23.0		7.3		BS		0950	
4	lab00395	PS	0900	lab00385	BS	1550	282								23.4		7.9		PS		1000	
5	lab00395	PS	0900	lab00395	BS	1500	282								23.9		7.5		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								24.3		6.9		PS		0945	
7	lab00395	BS	0920	lab00395	BS	1510	282								23.1		7.0		BS		0925	
8	lab00395	PS	0930	lab00395	PS	1615	282								23.2		8.2		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	124	158	~~3~~70	5/2 PS 1.6		5/24/12 7.6		22.9		8.2		PS		1110	
10															23.1		8.4		PS		1505	

* 3 organisms removed, replaced in D PS 5/15/12

† ~~7~~ organisms were weighed

…ality measurements will be taken upon the 1st renewal of the day on the "cut" water.

QC: [signature]

Weight Data for *Hyallela azteca* Growth

Test ID: TT01293
Start Date: 5/15/12
End Date: 5/25/12
Drying Temp: 100°C
Drying Time: 6h
Weighing Date: 5/29/12
Analyst: MBB
Client: TENUS

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1859	1.1866	0.7	9	0.078	
	B	1.1806	1.1811	0.5	10	0.05	
	C	1.1661	1.1671	1.0	9	0.11	
	D	1.1838	1.1855	1.7	12	0.14	
	E	1.1863	1.1868	0.5	6	0.083	
	F	1.1755	1.1763	0.8	8*	0.114	
	G	1.2040	1.2050	1.0	6	0.16	
	H	1.1716	1.1727	1.1	9	0.12	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

* one lost only 7 weighed

Avg. = 0.107

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved MBB

2012

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: TT01294
Sample ID: NTC17PCSD64
Organism Batch #: 0109
Organism Age: 12-14d

Laboratory ID: Tt
Client/Project: NW-Pathbans
Sediment Volume (mL): 100
Water Volume (mL): 175

Sediment Load Date/Time: 5/13/12 0945
Organism Load Date/Time: 5/15/12 1130
Test End Date/Time: 5/25/12 1045
Corresponding Control Test #: TT01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10	10	10	10	10	10	10	10*	PS	1130	
10	5	7	9	11	9	10	4	11	BS	1130	82.5

Day	Renewal Water Batch ID & Time: Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	PS	0945	lab00395	PS	1400					0.16	4.1	7.1	6.6	23.2	23.2	8.0	2.9	BS	PS	0940	1430
-1	lab00395	PS	0930	lab00395	PS	1430					4.0	2.7	6.9	7.2	22.5	23.4	1.7	5.0	PS	PS	0943	1430
0	lab00395	PS	0900	lab00395*	PS	1540	284	118	150	543	2.7	2.1	7.3	7.4	22.5	22.5	5.4	5.5	BS	PS	1030	1540
1	lab00395	PS	0930	lab00395	BS	1535	284								22.6		6.4		PS		0930	
2	lab00395	BS	0920	lab00395	BS	1530	284								23.2		6.8		BS		0920	
3	lab00395	BS	0930	lab00395	BS	1540	282								23.0		7.3		BS		0950	
4	lab00395	PS	0900	lab00395	BS	1550	282								23.4		7.1		PS		1000	
5	lab00395	PS	0900	lab00395	BS	1500	282								23.9		7.6		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								24.3		7.5		PS		0945	
7	lab00395	BS	0920	lab00395	BS	1510	282								23.1		7.6		BS		0825	
8	lab00395	PS	0930	lab00395	PS	1615	282								23.2		8.6		PS		0915	
9	lab00395	PS	0920	lab00395	BS	1600	282	110	100	494	2.0		7.5		22.9		7.8		PS		1110	
10															23.1		8.6		PS		1505	

*two organisms removed, replaced in H PS 5/15/12

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: [illegible]

2010

Weight Data for *Hyallela azteca* Growth

Test ID: TT01294
Start Date: 5/15/12
End Date: 5/25/12
Drying Temp: 100°C
Drying Time: 6h
Weighing Date: 5/29/12
Analyst: NYD
Client: TE NMS

Test ID	Replicate	A Weight of boat (~~m~~g)	B Dry Weight of foil and organisms (~~m~~g)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.2018	1.2022	0.4	5	0.08	
	B	1.1810	1.1818	0.8	7	0.114	
	C	1.1996	1.2003	0.7	9	0.078	
	D	1.1673	1.1691	0.8	11	0.072	
	E	1.1707	1.1718	1.1	9	0.12	
	F	1.2169	1.2179	1.0	10	0.10	
	G	1.1749	1.1754	0.6	4	0.15	
	H	1.1949	1.1961	1.2	11	0.11	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

Avg. = 0.103

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved NYD

2012

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: TT01295

Laboratory ID: TT

Sediment Load Date/Time: 5/13/12 0845

Sample ID: NTC 17 PC SD 68

Client/Project: [illegible]

Organism Load Date/Time: 5/15/12 1118

Organism Batch #: 0109

Sediment Volume (mL): 100 ~~[illegible]~~

Test End Date/Time: 5/25/12 1100

Organism Age: 12-14d

Water Volume (mL): 175

Corresponding Control Test #: TT01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10	10	10	10	10	10	10	10	BS	1118	87.5
10	10	8	10	8	9	8	7	10	PS	1210	

Day	Renewal Water Batch ID & Time: Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	la600395	BS	0945	lab00395	PS	1400					0.19	1.3	7.1	7.1	23.2	23.2	8.0	4.4	BS	PS	0900	1430
-1	lab00395	PS	0930	lab00395	PS	1430					2.1	1.0	7.0	6.9	22.5	23.4	2.1	5.7	PS	PS	0943	1430
0	lab00395	PS	0900	lab00395	PS	1540	284	116	132	547	1.0	1.3	6.7	7.1	22.5	22.5	5.7	5.6	PS	PS	1030	1540
1	lab00395	PS	0930	la500395	BS	1535	284								22.6		7.4		PS		0930	
2	la500395	BS	0930	la500395	BS	1530	284								23.2		7.8		BS		0920	
3	la500395	BS	0930	la500395	BS	1540	282								23.0		8.0		BS		0950	
4	lab00395	PS	0900	la500395	BS	1550	282								23.4		7.9		PS		1000	
5	lab00395	PS	0900	la500395	BS	1500	282								23.9		8.0		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								24.3		8.2		PS		0945	
7	la500395	BS	0920	la500395	BS	1510	282								23.1		7.5		BS		0925	
8	la500395	BS	0930	lab00395	PS	1615	282								23.2		8.8		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	142	160	509	0.8		7.3		22.9		8.5		PS		1110	
10															23.1		7.8		PS		1505	

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: [illegible]

2010

Weight Data for *Hyallela azteca* Growth

Test ID: TT01295 Start Date: 5/15/12 End Date: 5/25/12
Drying Temp: 100°C Drying Time: 6h Weighing Date: 5/29/12
Analyst: NKB Client: Tt NUS

Test ID	Replicate	A Weight of boat (~~mg~~g)	B Dry Weight of foil and organisms (~~mg~~g)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1680	1.1695	~~0~~ 1.5	10	0.15	
	B	1.1786	1.1795	0.9	8	0.11	
	C	1.1810	1.1824	1.4	10	0.14	
	D	1.1842	1.1849	0.7	8	0.088	
	E	1.1836	1.1846	1.0	9	0.11	
	F	1.1971	1.1977	0.6	8	0.075	
	G	1.2070	1.2084	1.4	7	0.2	
	H	1.1852	1.1864	1.2	10	0.12	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

Avg. = 0.124

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved NKB

2012

Hyalella azteca 10-Day Sediment Toxicity Test

Test #:	Tt01296
Sample ID:	NTC17PCSD 61
Organism Batch #:	0109
Organism Age:	12-14d
Laboratory ID:	Tt
Client/Project:	NWS Pathfdr
Sediment Volume (mL):	100
Water Volume (mL):	175
Sediment Load Date/Time:	5/13/12 0935
Organism Load Date/Time:	5/15/12 1116
Test End Date/Time:	5/25/12 1130
Corresponding Control Test #:	TT01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10	10	10	10	10	10	10	10	PS	1116	93.8
10	10	10	10	9	10	9	7	10	BS	1325	

Day	Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	BS	0935	lab00395	PS	1400					0.10	0.08	7.1	6.8	23.2	23.2	8.0	4.1	BS	PS	0900	1420
-1	lab00395	PS	0930	lab00395	PS	1430					0.10	0.14	7.1	7.0	22.5	23.4	5.0	6.1	PS	PS	0943	1430
0	lab00395	PS	0900	lab00395	PS	1540	284	84	148	449	0.04	ND	6.9	7.2	22.5	22.5	6.1	6.4	PS	PS	1030	1540
1	lab00395	PS	0930	lab00395	BS	1535	284								22.6		7.8		PS		0930	
2	lab00395	BS	0920	lab00395	BS	1530	284								23.2		8.4		BS		0920	
3	lab00395	BS	0930	lab00395	BS	1540	282								23.0		8.2		BS		0950	
4	lab00395	PS	0900	lab00395	BS	1550	282								23.4		7.8		PS		1000	
5	lab00395	PS	0900	lab00395	BS	1500	282								22.9		7.5		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								24.3		8.9		PS		0945	
7	lab00395	BS	0920	lab00395	BS	1510	282								23.1		9.1		BS		0925	
8	lab00395	BS	0930	lab00395	PS	1615	282								23.2		8.9		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	62	144	428	0.19		7.4		22.9		9.0		PS		1110	
10															23.1		7.9		PS		1505	

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: MSB

2010

Weight Data for *Hyallela azteca* Growth

Test ID: TT01296
Start Date: 5/15/12
End Date: 5/25/12
Drying Temp: 100°C
Drying Time: 6h
Weighing Date: 5/29/12
Analyst: MSD
Client: TT NWS

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1824	1.1835	0.9	10	0.09	
	B	1.1810	1.1820	1.0	10	0.10	
	C	1.1965	1.1977	1.2	10	0.12	
	D	1.1695	1.1702	0.7	9	0.078	
	E	1.1792	1.1799	0.7	10	0.07	
	F	1.1816	1.1821	0.5	9	0.056	
	G	1.1925	1.1936	1.1	7	0.16	
	H	1.2095	1.2104	0.9	10	0.09	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

Avg. = 0.096

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: Tt01297
Laboratory ID: Tt
Sediment Load Date/Time: 5/13/12 1000

Sample ID: NTC17PCSD63
Client/Project: NUS Pathkin
Organism Load Date/Time: 5/15/12 1123

Organism Batch #: 0109
Sediment Volume (mL): 100
Test End Date/Time: 5/25/12 1145

Organism Age: 12-14d
Water Volume (mL): 175
Corresponding Control Test #: Tt01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10	10	10	10*	10	10	10	10	PS	1123	93.8
10	10	8	10	11	8	8	10	10	PS	1355	

Day	Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	PS	1000	lab00395	PS	1400					0.10	0.43	7.1	6.9	23.2	23.2	8.0	3.6	PS	PS	0920	1430
-1	lab00395	PS	0930	lab00395	PS	1430					0.53	0.27	7.2	7.1	22.5	23.4	4.5	5.8	PS	PS	0943	1430
0	lab00395	PS	0900	lab00395	PS	1540	284	80	116	439	0.37	0.26	7.1	7.4	22.5	22.5	6.1	6.1	PS	PS	1030	1540
1	lab00395	PS	0930	lab00395	PS	1535	284								22.6		7.5		PS		0930	
2	lab00395	PS	0920	lab00395	PS	1520	284								23.2		8.5		PS		0920	
3	lab00395	PS	0930	lab00395	PS	1540	282								23.0		8.4		PS		0950	
4	lab00395	PS	0900	lab00395	PS	1550	282								23.4		8.1		PS		1000	
5	lab00395	PS	0900	lab00395	PS	1500	282								23.9		7.6		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								24.3		8.0		PS		0945	
7	lab00395	PS	0920	lab00395	PS	1510	282								23.1		8.3		PS		0925	
8	lab00395	PS	0930	lab00395	PS	1615	282								23.2		8.6		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	98	154	476	0.04		7.5		22.9		8.4		PS		1110	
10															23.1		7.9		PS		1505	

*two organisms removed, replaced in D PS 5/15/12

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: [illegible]

Weight Data for *Hyallela azteca* Growth

Test ID: TT01297 | Start Date: 5/15/12 | End Date: 5/25/12
Drying Temp: 100°C | Drying Time: 6h | Weighing Date: 5/29/12
Analyst: N&D | Client: TT NWS

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1790	1.1801	2.1	10	0.21	
	B	1.1784	1.1796	1.2	8	0.15	
	C	1.1832	1.1842	1.0	10	0.10	
	D	1.1882	1.1896	1.4	11	0.13	
	E	1.1948	1.1962	1.4	8	0.175	
	F	1.1720	1.1723	0.3	8	0.04	
	G	1.1617	1.1627	1.0	10	0.10	
	H	1.1690	1.1702	1.2	10	0.12	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1639	-0.1			

Avg. = 0.128

Data Checked and Approved NSD

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: TT01298
Laboratory ID: TT
Sediment Load Date/Time: 5/13/12 1000
Sample ID: NTC17PCSD54
Client/Project: NWS Pathways
Organism Load Date/Time: 5/15/12 1121
Organism Batch #: 0109
Sediment Volume (mL): 100
Test End Date/Time: 5/25/12 1200
Organism Age: 12-14d
Water Volume (mL): 175
Corresponding Control Test #: TT01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10	10	10	10*	10	10	10	10	PS	1121	NS 5/A/12 ~~81.3~~
10	6	10	10	10	10	9	9	10	PS	1430	92.5

Day	Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	BS	1000	lab00395	PS	1400					0.10	0.15	7.1	6.9	23.2	23.2	5.2	5.6	BS	PS	0900	1430
-1	lab00395	PS	0930	lab00395	PS	1430					0.11	0.07	7.2	7.1	22.5	23.4	5.0	6.1	PS	PS	0945	1430
0	lab00395	PS	0900	lab00395*	PS	1540	284	96	130	499	0.01	0.03	7.0	7.3	22.5	22.5	6.3	6.6	PS	PS	1030	1540
1	lab00395	PS	0930	lab00395	BS	1535	284								22.6		7.9		PS		0930	
2	lab00395	BS	0920	lab00395	BS	1520	294								23.2		8.5		BS		0920	
3	lab00395	BS	0920	lab00395	BS	1540	282								23.0		8.3		BS		0850	
4	lab00395	PS	0900	lab00395	BS	1550	282								23.4		8.1		PS		1000	
5	lab00395	PS	0900	lab00395	BS	1500	282								23.9		7.8		BS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								24.3		8.9		PS		0945	
7	lab00395	BS	0920	lab00395	BS	1510	282								23.1		8.1		BS		0925	
8	lab00395	PS	0930	lab00395	PS	1615	282								23.2		6.8		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	90	124	442	0.06		7.6		22.9		8.9		PS		1110	
10															23.1		8.2		PS		1505	

*one organism removed from unknown replaced in D PS 5/15/12

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: NDB

2010

Weight Data for *Hyallela azteca* Growth

Test ID: TT01298
Start Date: 5/15/12
End Date: 5/25/12
Drying Temp: 100°C
Drying Time: 6h
Weighing Date: 5/29/12
Analyst: NSB
Client: TtNUS

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1657	1.1667	1.0	~~10~~ 6	0.167	
	B	1.1806	1.1818	1.2	10	0.12	
	C	1.1851	1.1862	1.1	10	0.11	
	D	1.1853	1.1868	1.5	10	0.15	
	E	1.1747	1.1763	1.6	10	0.16	
	F	1.1885	1.1893	0.8	9	0.089	
	G	1.1745	1.1757	1.2	9	0.133	
	H	1.1915	1.1925	1.0	10	0.10	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

Avg. = 0.129

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved NSB

2012

Hyalella azteca 10-Day Sediment Toxicity Test

Test #: TT1299

Laboratory ID: TT

Sediment Load Date/Time: 5/13/12 0930

Sample ID: NTC17PCSD66

Client/Project: NWS Pathways

Organism Load Date/Time: 5/15/12 1033

Organism Batch #: 0109

Sediment Volume (mL): 100

Test End Date/Time: 5/25/12 1115

Organism Age: 12-14d

Water Volume (mL): 175

Corresponding Control Test #: TT01291

Day	Replicate 1	2	3	4	5	6	7	8	Analyst	Time	Final Mean % Survival (# Surviving / # Exposed X 100)
0	10	10	10	10	10	10	10	10	PS	1033	95
10	8	10	9	10	10	10	~~8~~ 9 BS	10	PS	1430	

Day	Renewal 1	Analyst	Time	Renewal 2	Analyst	Time	YCT #	Alk (mg/L as $CaCO_3$)	Hard (mg/L as $CaCO_3$)	Cond. (µS)	NH_3 (mg/L) AM	NH_3 (mg/L) PM	pH AM	pH PM	Temp (°C) AM	Temp (°C) PM	DO (mg/L) AM	DO (mg/L) PM	Analyst AM	Analyst PM	Time AM	Time PM
-2	lab00395	BS	0930	lab00395	PS	1400					0.10	0.35	7.1	7.1	23.2	23.2	8.0	5.3	BS	PS	0900	1430
-1	lab00395	PS	0930	lab00395	PS	1430					0.50	0.30	7.2	6.6	22.5	22.5	5.9	5.7	PS	PS	0943	1430
0	lab00395	PS	0900	lab00395*	PS	1540	284	100	120	471	0.27	0.16	6.6	6.8	23.0	23.0	5.9	6.2	PS	PS	1030	1540
1	lab00395	PS	0930	lab00795	BS	1535	284								22.5		8.0		PS		0930	
2	lab00395	BS	0920	lab00395	BS	1530	284								22.7		8.5		BS		0920	
3	lab00395	BS	0930	lab00395	BS	1540	282								23.1		8.4		BS		0950	
4	lab00395	PS	0900	lab00395	BS	1550	282								23.1		8.2		PS		1000	
5	lab00395	PS	0900	lab00395	BS	1500	282								22.7		7.8		PS		1000	
6	lab00395	PS	0930	lab00395	PS	1550	282								22.8		8.6		PS		0945	
7	lab00395	BS	0920	lab00395	BS	1510	282								22.6		8.4		BS		0925	
8	lab00395	PS	0930	lab00395	PS	1615	282								22.6		8.8		PS		0915	
9	lab00395	PS	0920	lab00395	PS	1600	282	116	162	468	0.04		7.1		22.6		8.7		PS		1110	
10															22.7		8.1		PS		1505	

* One organism removed from rep D, replaced PS 5/15/12

Water quality measurements will be taken upon the 1st renewal of the day on the "out" water.

QC: MSB

2010

Weight Data for *Hyallela azteca* Growth

Test ID: TTO 1299 | Start Date: 5/15/12 | End Date: 5/25/12
Drying Temp: 100°C | Drying Time: 6h | Weighing Date: 5/29/12
Analyst: NWS | Client: TT NWS

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1640	1.1658	1.8	8	0.225	
	B	1.1836	1.1845	0.9	10	0.09	
	C	1.1807	1.1822	1.5	9	0.17	
	D	1.1778	1.1795	1.7	10	0.17	
	E	1.1914	1.1938	2.4	10	0.24	
	F	1.1863	1.1870	0.7	10	0.07	
	G	1.1873	1.1891	1.8	9	0.20	
	H	1.2631	1.2043	1.2	10	0.12	
Blanks	A	1.1760	1.1761	0.1			
	B	1.1639	1.1638	-0.1			

Avg. = 0.161

Tetra Tech, Inc.
Ecological Testing Facility

Data Checked and Approved NWS

2012

Weight Data for *Hyallela azteca* Growth

Test ID: Initial Weight
Start Date: 5/15/12
End Date: 5/25/12
Drying Temp: 60°C
Drying Time: 24hrs.
Weighing Date: 5/16/12
Analyst: MBB/BS
Client: TT

Test ID	Replicate	A Weight of boat (mg)	B Dry Weight of foil and organisms (mg)	B-A Total Dry Weight of organisms (mg)	C Number of organisms	(B-A)/C Mean Dry Weight of organisms (mg)	Remarks
	A	1.1906	1.1913	~~7.0~~ 0.7	10	0.07	
	B	1.1946	1.1952	~~6.0~~ 0.6	10	0.06	
	C	1.1721	1.1727	~~6.0~~ 0.6	10	0.06	
	D	1.1918	1.1925	0.7	10	0.07	
	E	1.2131	1.2139	0.8	10	0.08	
	F	1.1824	1.1827	0.3	10	0.03	
	G	1.1828	1.1836	0.8	10	0.08	
	H	1.1819	1.1827	0.8	10	0.08	
Blanks	A	1.1810	1.1811	0.1			
	B	1.2111	1.2110	-0.1			

Avg=0.066

C. STATISTICAL ANALYSIS

Table C-1. Summary of statistical analysis of survival for 10-Day Pettibone Creek sediment test using *H. azteca*. Highlighted cells are significant at $p<0.05$.

	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}	{9}
Control {1}		0.303747	0.196071	0.086164	0.245873	0.632875	0.646148	0.550551	0.733475
NTC17PCSD53 {2}	0.303747		0.750289	0.443452	0.864793	0.540128	0.524092	0.609645	0.455196
NTC17PCSD60 {3}	0.196071	0.750289		0.609645	0.864793	0.378538	0.369725	0.443452	0.310456
NTC17PCSD64 {4}	0.086164	0.443452	0.609645		0.524092	0.191145	0.184939	0.230648	0.150307
NTC17PCSD68 {5}	0.245873	0.864793	0.864793	0.524092		0.455196	0.443452	0.524092	0.378538
NTC17PCSD61 {6}	0.632875	0.540128	0.378538	0.191145	0.455196		1.000000	0.873815	0.864793
NTC17PCSD63 {7}	0.646148	0.524092	0.369725	0.184939	0.443452	1.000000		0.864793	0.873815
NTC17PCSD54 {8}	0.550551	0.609645	0.443452	0.230648	0.524092	0.873815	0.864793		0.759950
NTC17PCSD66 {9}	0.733475	0.455196	0.310456	0.150307	0.378538	0.864793	0.873815	0.759950	

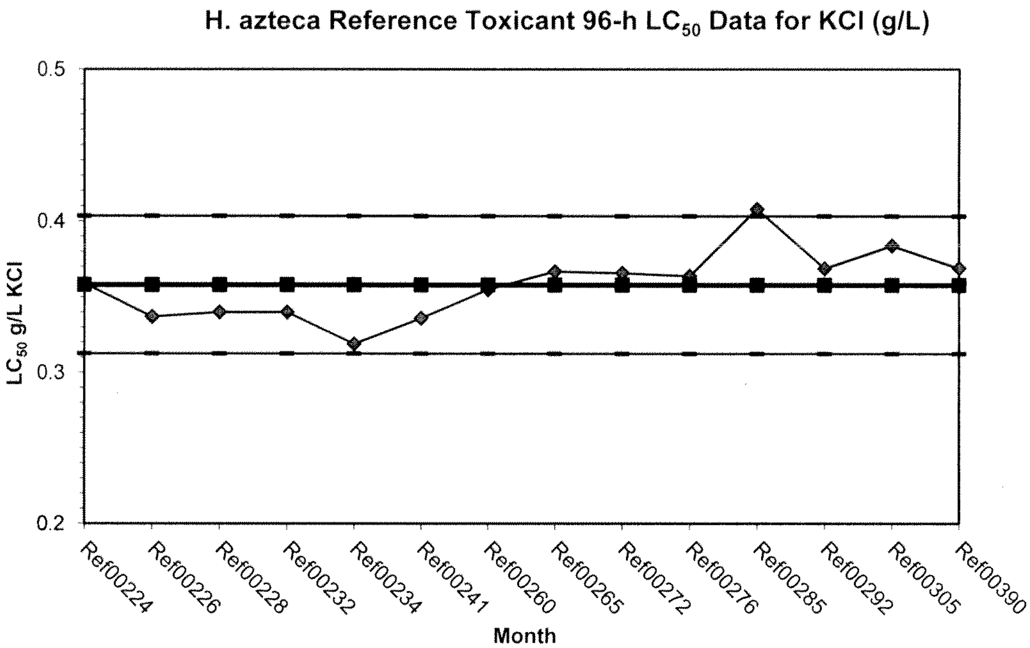
Table C-2. Summary of statistical analysis of weight of survivors (growth) for 10-day Pettibone Creek sediment tests using *H. azteca*. Highlighted cells are significant at $p<0.05$.

	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}	{9}
Control {1}		0.243461	0.431619	0.523843	0.134121	0.756750	0.098984	0.098402	0.002456
NTC17PCSD53 {2}	0.243461		0.651176	0.546750	0.687230	0.360040	0.574088	0.573621	0.049856
NTC17PCSD60 {3}	0.431619	0.651176		0.847695	0.423744	0.598021	0.342646	0.343739	0.019651
NTC17PCSD64 {4}	0.523843	0.546750	0.847695		0.345508	0.710128	0.273556	0.272877	0.013369
NTC17PCSD68 {5}	0.134121	0.687230	0.423744	0.345508		0.211658	0.842841	0.835019	0.101544
NTC17PCSD61 {6}	0.756750	0.360040	0.598021	0.710128	0.211658		0.161541	0.160985	0.005461
NTC17PCSD63 {7}	0.098984	0.574088	0.342646	0.273556	0.842841	0.161541		0.980310	0.131343
NTC17PCSD54 {8}	0.098402	0.573621	0.343739	0.272877	0.835019	0.160985	0.980310		0.116115
NTC17PCSD66 {9}	0.002456	0.049856	0.019651	0.013369	0.101544	0.005461	0.131343	0.116115	

Table C-3 Summary of statistical analysis of weight of originals (biomass) for 10-day Pettibone Creek sediment tests using *H. azteca*. Highlighted cells are significant at p<0.05.

	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}	{9}
Control {1}		0.453119	0.841105	0.802832	0.305834	1.000000	0.132092	0.157347	0.003640
NTC17PCSD53 {2}	0.453119		0.547907	0.347722	0.738310	0.470492	0.399529	0.453119	0.023926
NTC17PCSD60 {3}	0.841105	0.547907		0.674232	0.381326	0.851563	0.175617	0.205203	0.005741
NTC17PCSD64 {4}	0.802832	0.347722	0.674232		0.225242	0.789233	0.089381	0.109342	0.001992
NTC17PCSD68 {5}	0.305834	0.738310	0.381326	0.225242		0.318228	0.573793	0.640069	0.045412
NTC17PCSD61 {6}	1.000000	0.470492	0.851563	0.789233	0.318228		0.137608	0.165046	0.003985
NTC17PCSD63 {7}	0.132092	0.399529	0.175617	0.089381	0.573793	0.137608		0.893698	0.112163
NTC17PCSD54 {8}	0.157347	0.453119	0.205203	0.109342	0.640069	0.165046	0.893698		0.103614
NTC17PCSD66 {9}	0.003640	0.023926	0.005741	0.001992	0.045412	0.003985	0.112163	0.103614	

D. QUALITY ASSURANCE/QUALITY CONTROL



Test Log #	Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
Ref00224	05/27/10	0.3590	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00226	05/28/10	0.3370	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00228	06/02/10	0.3400	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00232	06/03/10	0.3400	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00234	06/04/10	0.3190	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00241	06/16/10	0.3360	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00260	06/29/10	0.3550	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00265	07/16/10	0.3670	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00272	08/06/10	0.3660	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00276	08/25/10	0.3640	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00285	09/24/10	0.4080	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00292	10/19/10	0.3690	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00305	11/09/10	0.3840	0.3581	0.3354	0.3127	0.3808	0.4035
Ref00390	05/15/12	0.3693	0.3581	0.3354	0.3127	0.3808	0.4035

Mean	0.3581
SD	0.0227
CV%	6.3442

ACUTE TOXICITY TEST BENCH SHEET

Test #: REF00390

START Date/Time: 5/15/12 1245

FINISH Date/Time: 5/19/12 1339

Dilution Water: LAB0395

Test Substance: KCl

Client/Project: TT

Species: H. azteca

Concentration & Replicate		Number alive/hour of test: Start	24	48	72	96	# alive / # exposed (percent survival)	Comments
0	A	10	10	10	10	10	100%	
	B	10	10	10	10	10		
	C	10	10	10	10	10		
	D	10	10	10	10	10		
0.125	A	10	10	10	10	10	97.5%	
	B	10	10	10	10	10		
	C	10	10	10	10	9		
	D	10	10	~~8~~ ~~9~~ 10	10	10		
0.25	A	10	10	10	10	10	92.5%	
	B	10	10	10	10	9		
	C	10	10	9	9	9		
	D	10	10	10	10	9		
0.5	A	10	10	3	2	2	~~0.075%~~ 7.5%	
	B	10	9	2	2	1		
	C	10	10	3	0	0		
	D	10	9	4	0	0		
1	A	10	0	0	0	0	0.0%	
	B	10	0	0	0	0		
	C	10	0	0	0	0		
	D	10	0	0	0	0		
2	A	10	0	0	0	0	0.0%	
	B	10	0	0	0	0		
	C	10	0	0	0	0		
	D	10	0	0	0	0		
ANALYST		BS	BS	BS	BS	BS		
TIME RENEWED		1245	1017	1014	1000	1339		

ACUTE TOXICITY CHEMISTRY BENCH SHEET   Test #: REF00390

START Date/Time: 5/15/12 1245   FINISH Date/time: 5/19/12 1334

Dilution Water: Lab 0395   Test Substance: KCl

Client Project: TT   Species: H. Azteca

Test Conc.	Chemical Parameters	Hour of Test: 0	48h	96		Comments
0	Cond	332	388	432		
	DO	8.6	8.3	8.2		
	pH	6.7	7.2	7.5		
	Before Temp	~~24.5~~ BS 5/15	22.8	23.1		
	After Temp	23.0				
0.125	Cond	442	577	691		
	DO	8.6	8.9	8.7		
	pH	6.7	7.2	7.1		
	Before Temp	~~24.5~~ BS 5/15	22.7	23.1		
	After Temp	23.0				
0.25	Cond	903	865	954		
	DO	8.7	9.1	8.5		
	pH	6.6	7.2	7.0		
	Before Temp	~~24.5~~ BS 5/15	22.7	23.1		
	After Temp	23.0				
0.5	Cond	1265	1395	1422		
	DO	8.8	8.8	8.5		
	pH	6.6	~~8.~~ BS 5/17/12 7.2	7.0		
	Before Temp	~~24.5~~ BS 5/15	22.7	23.1		
	After Temp	23.0				
1	Cond	2140	2100 *			
	DO	8.7	8.2 *			
	pH	6.6	6.6 *			
	Before Temp	~~24.5~~ BS 5/15				
	After Temp	23.0	22.5 *			
2	Cond	3470	3780 *		BS 5/16/12	
	DO	8.8	8.5 *			
	pH	6.6	6.6 *			
	Before Temp	~~24.5~~ BS 5/15				
	After Temp	23.0	22.5 *			
Analyst		BS	BS / BS	BS		
Time Analyzed		1255	1021 / 1021	1340		

* Taken at 24h - 100% mortality

Tetra Tech, Inc.
Ecological Testing Facility   Data Checked and Approved: [signature]   2012

Toxicity Test Procedure Check Sheet

Date________________

Test ID Number REF00390

Type of Test Chamber 300mL beaker

Number of replicates per concentration 4

Specify vessel type and volume used to measure and deliver effluent and dilutent to test chambers________________

Graduated Cylinder(s)__________ Pipet(s)__________

Volumetric Flask(s) 1L , 2L Other__________

Specify materials used to place the test organisms into the test chambers____________________

Test ID Number	Loading QC Initials
REF00390	

Exposure Chamber

Total Vessel Capacity 300mL

Test Solution volume 150mL

Feeding Schedule

Not fed________

Fed Daily_______

Other_______

Type of food__________

Specify below the number of milliliters (mls) of diluent and effluent measured out per concentration in this test.

Treatment Concentration	Working Stock Solution	Diluent	Total Volume
0	0L	1L	1L
0.125	1L	1L	2L
0.25	1L	1L	2L
0.5	1L	1L	2L
1	1L	1L	2L
2	2L	0L	2L

Aeration

Yes or No

Time Began:_____

Screened Animal Enclosures

~~Not used~~

Used

Photoperiod

dark 8 ~~hr / light 16hr~~

other_____

Tetra Tech, Inc.
Ecological Testing Facility

CETIS Summary Report

Report Date: 29 May-12 11:59 (p 1 of 1)
Test Code: Ref00390 | 00-1953-0166

Hyallela 96-h Water Column Survival Test — Tetra Tech, Inc.

Batch ID:	18-1951-9084	Test Type:	Survival (96h)	Analyst:	
Start Date:	15 May-12 12:45	Protocol:	EPA/600/R-99/064 (2000)	Diluent:	Mod-Hard Synthetic Water
Ending Date:	19 May-12 13:39	Species:	Hyalella azteca	Brine:	
Duration:	4d 1h	Source:	Aquatic Biosystems, CO	Age:	<15d

Sample ID:	20-5949-9629	Code:	7AC1786D	Client:	
Sample Date:	15 May-12 11:45	Material:	Potassium chloride	Project:	Reference Toxicant
Receive Date:		Source:	Reference Toxicant		
Sample Age:	60m	Station:			

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
08-1445-0540	96h Survival Rate	0.25	0.5	0.3536	9.29%		Dunnett's Multiple Comparison Test

Point Estimate Summary

Analysis ID	Endpoint	Level	gm/L	95% LCL	95% UCL	TU	Method
10-2341-4032	96h Survival Rate	EC5	0.1859	0.01919	0.2986		Linear Interpolation (ICPIN)
		EC10	0.2567	0.246	0.2766		
		EC15	0.2703	0.2588	0.2891		
		EC20	0.284	0.2717	0.3018		
		EC25	0.2978	0.2848	0.3146		
		EC40	0.3402	0.3249	0.3619		
		EC50	0.3693	0.3523	0.3944		

96h Survival Rate Summary

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
0.125		4	0.975	0.9563	0.9937	0.9	1	0.025	0.05	5.13%	2.5%
0.25		4	0.925	0.9063	0.9437	0.9	1	0.025	0.05	5.41%	7.5%
0.5		4	0.075	0.03925	0.1108	0	0.2	0.04787	0.09574	127.7%	92.5%
1		4	0	0	0	0	0	0	0		100.0%
2		4	0	0	0	0	0	0	0		100.0%

96h Survival Rate Detail

Conc-gm/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
0.125		1	1	0.9	1
0.25		1	0.9	0.9	0.9
0.5		0.2	0.1	0	0
1		0	0	0	0
2		0	0	0	0

CETIS Measurement Report

Report Date:	29 May-12 11:59 (p 1 of 2)
Test Code:	Ref00390 | 00-1953-0166

Hyallela 96-h Water Column Survival Test — **Tetra Tech, Inc.**

Batch ID:	18-1951-9084	**Test Type:**	Survival (96h)	**Analyst:**	
Start Date:	15 May-12 12:45	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	19 May-12 13:39	**Species:**	Hyalella azteca	**Brine:**	
Duration:	4d 1h	**Source:**	Aquatic Biosystems, CO	**Age:**	<15d

Sample ID:	20-5949-9629	**Code:**	7AC1786D	**Client:**	
Sample Date:	15 May-12 11:45	**Material:**	Potassium chloride	**Project:**	Reference Toxicant
Receive Date:		**Source:**	Reference Toxicant		
Sample Age:	60m	**Station:**			

Conductivity-μmhos

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	384.3	367.4	401.3	332	432	28.96	50.16	13.05%	0
0.125		3	576.7	534.1	619.2	442	691	72.6	125.7	21.8%	0
0.25		3	874	848.3	899.7	803	954	43.82	75.9	8.68%	0
0.5		3	1361	1332	1389	1265	1422	48.46	83.94	6.17%	0
1		2	2120	2110	2130	2100	2140	20	28.28	1.33%	0
2		2	3825	3803	3847	3780	3870	45	63.64	1.66%	0
Overall		16	1523			332	3870				0 (0%)

Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	8.367	8.296	8.437	8.2	8.6	0.1202	0.2082	2.49%	0
0.125		3	8.733	8.682	8.785	8.6	8.9	0.08819	0.1527	1.75%	0
0.25		3	8.767	8.663	8.87	8.5	9.1	0.1764	0.3055	3.49%	0
0.5		3	8.7	8.641	8.759	8.5	8.8	0.1	0.1732	1.99%	0
1		2	8.45	8.33	8.57	8.2	8.7	0.25	0.3536	4.18%	0
2		2	8.65	8.578	8.722	8.5	8.8	0.15	0.2121	2.45%	0
Overall		16	8.611			8.2	9.1				0 (0%)

pH-Units

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	7.133	6.997	7.27	6.7	7.5	0.2333	0.4041	5.67%	0
0.125		3	7	6.91	7.09	6.7	7.2	0.1528	0.2646	3.78%	0
0.25		3	6.933	6.83	7.037	6.6	7.2	0.1764	0.3055	4.41%	0
0.5		3	6.933	6.83	7.037	6.6	7.2	0.1764	0.3055	4.41%	0
1		2	6.6	6.599	6.601	6.6	6.6	0	0	0.0%	0
2		2	6.6	6.599	6.601	6.6	6.6	0	0	0.0%	0
Overall		16	6.867			6.6	7.5				0 (0%)

Temperature-°C

Conc-gm/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	QA Count
0	Dilution Water	3	22.93	22.86	23	22.7	23.1	0.1202	0.2082	0.91%	0
0.125		3	22.93	22.86	23	22.7	23.1	0.1202	0.2082	0.91%	0
0.25		3	22.93	22.86	23	22.7	23.1	0.1202	0.2082	0.91%	0
0.5		3	22.93	22.86	23	22.7	23.1	0.1202	0.2082	0.91%	0
1		2	22.75	22.63	22.87	22.5	23	0.25	0.3536	1.55%	0
2		2	22.75	22.63	22.87	22.5	23	0.25	0.3536	1.55%	0
Overall		16	22.87			22.5	23.1				0 (0%)

Conductivity-µmhos

Conc-gm/L	Control Type	1	2	3
0	Dilution Water	332	389	432
0.125		442	597	691
0.25		803	865	954
0.5		1265	1395	1422
1		2140	2100	
2		3870	3780	

Dissolved Oxygen-mg/L

Conc-gm/L	Control Type	1	2	3
0	Dilution Water	8.6	8.3	8.2
0.125		8.6	8.9	8.7
0.25		8.7	9.1	8.5
0.5		8.8	8.8	8.5
1		8.7	8.2	
2		8.8	8.5	

pH-Units

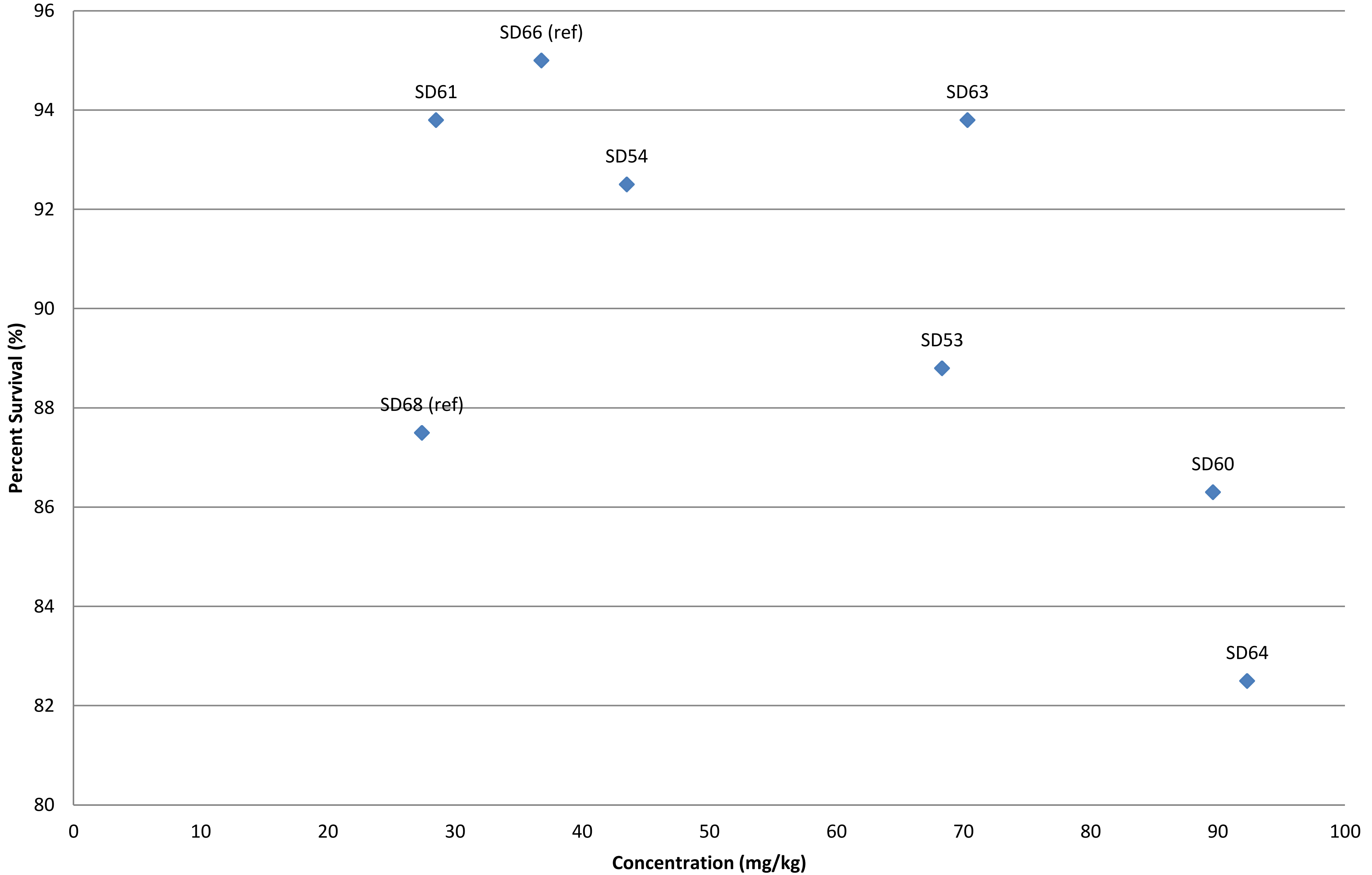
Conc-gm/L	Control Type	1	2	3
0	Dilution Water	6.7	7.2	7.5
0.125		6.7	7.2	7.1
0.25		6.6	7.2	7
0.5		6.6	7.2	7
1		6.6	6.6	
2		6.6	6.6	

Temperature-°C

Conc-gm/L	Control Type	1	2	3
0	Dilution Water	23	22.7	23.1
0.125		23	22.7	23.1
0.25		23	22.7	23.1
0.5		23	22.7	23.1
1		23	22.5	
2		23	22.5	

TOXICITY CONCENTRATION PLOTS

Figure E-1
Copper Concentration in Sediment vs Survival of *Hyalella azteca*



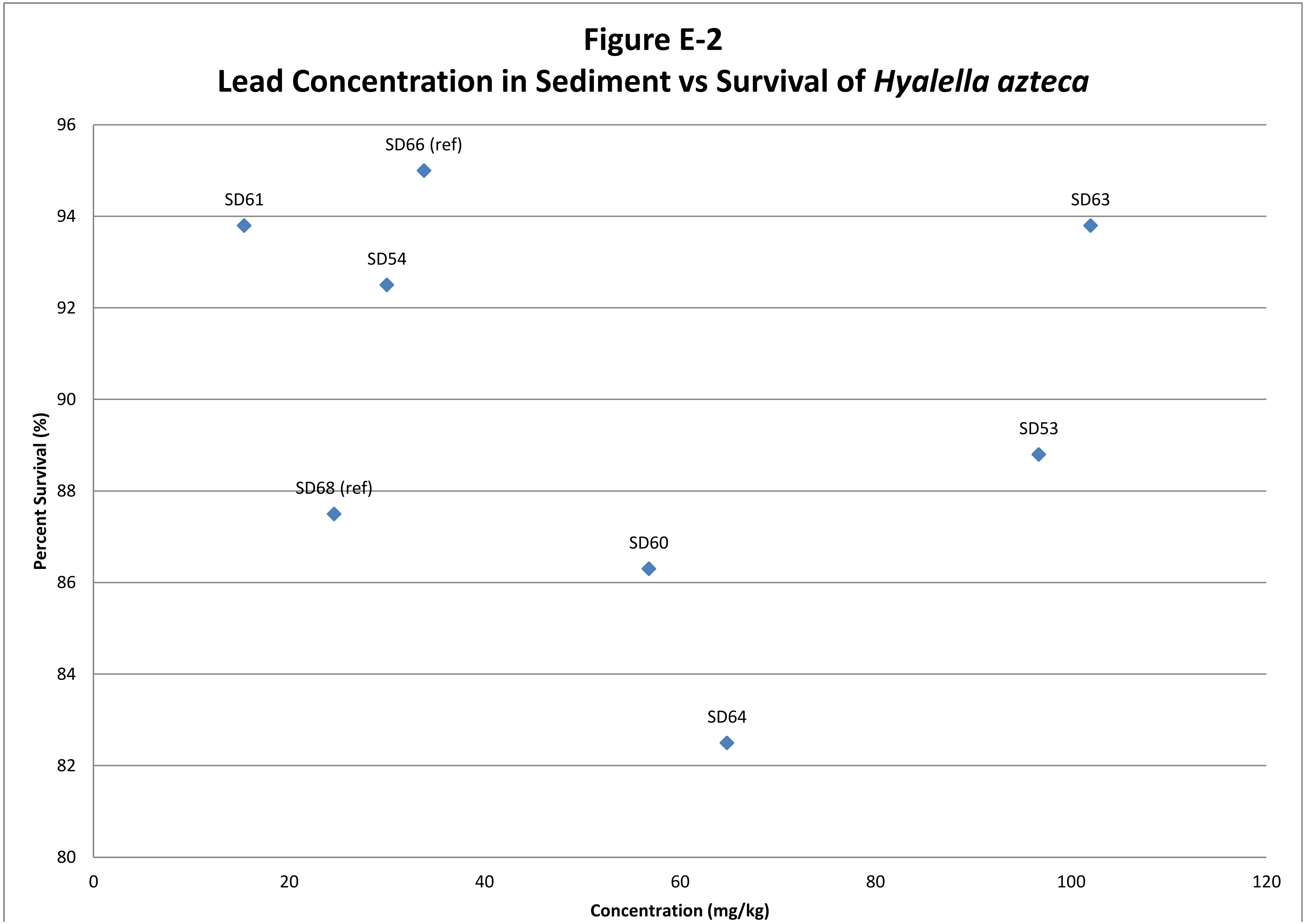


Figure E-2
Lead Concentration in Sediment vs Survival of *Hyalella azteca*
Percent Survival (%)
Concentration (mg/kg)
96
94
92
90
88
86
84
82
80
0
20
40
60
80
100
120
SD66 (ref)
SD61
SD63
SD54
SD53
SD68 (ref)
SD60
SD64

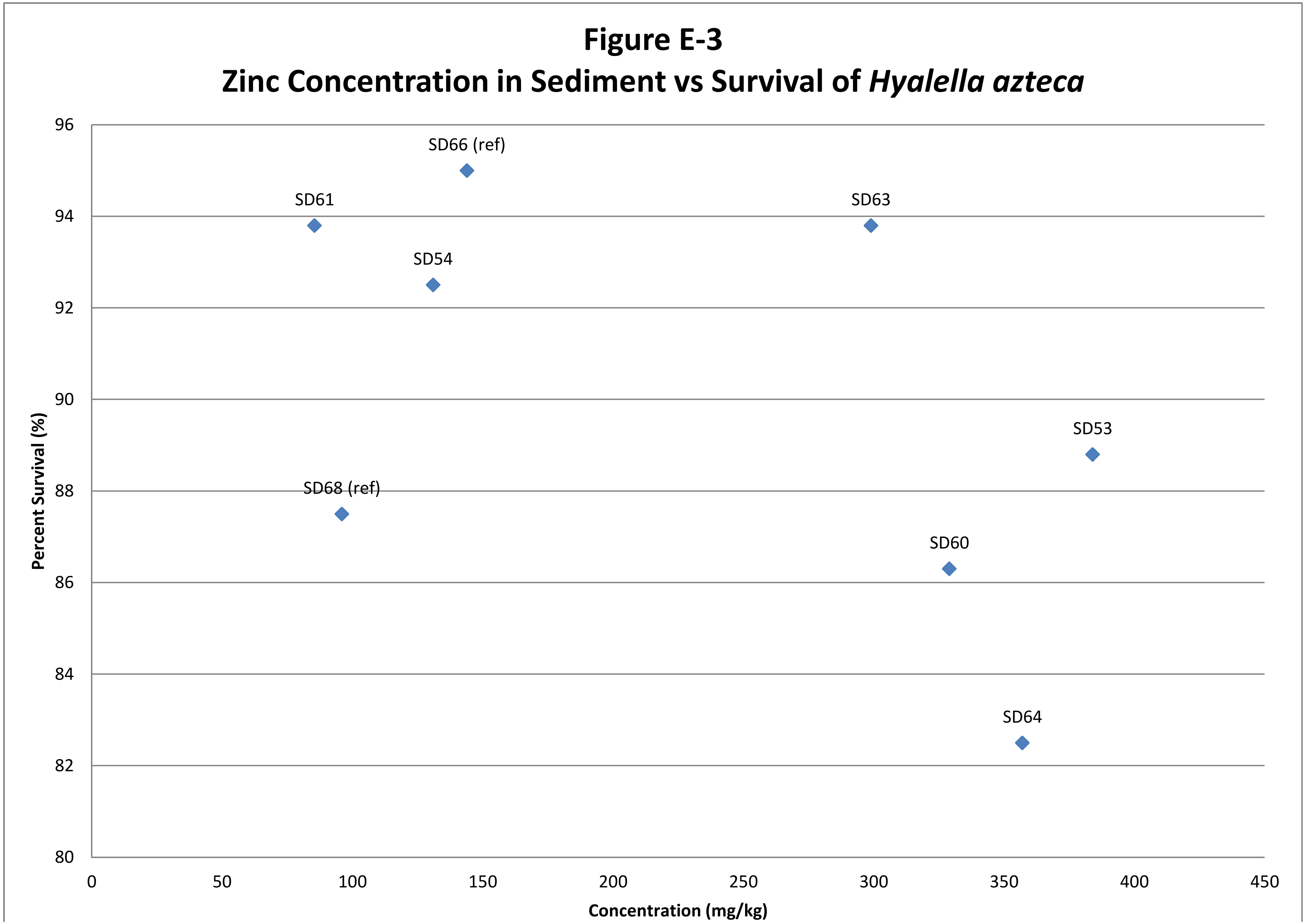


Figure E-3
Zinc Concentration in Sediment vs Survival of *Hyalella azteca*
Percent Survival (%)
Concentration (mg/kg)
96
94
92
90
88
86
84
82
80
0
50
100
150
200
250
300
350
400
450
SD66 (ref)
SD61
SD63
SD54
SD53
SD68 (ref)
SD60
SD64

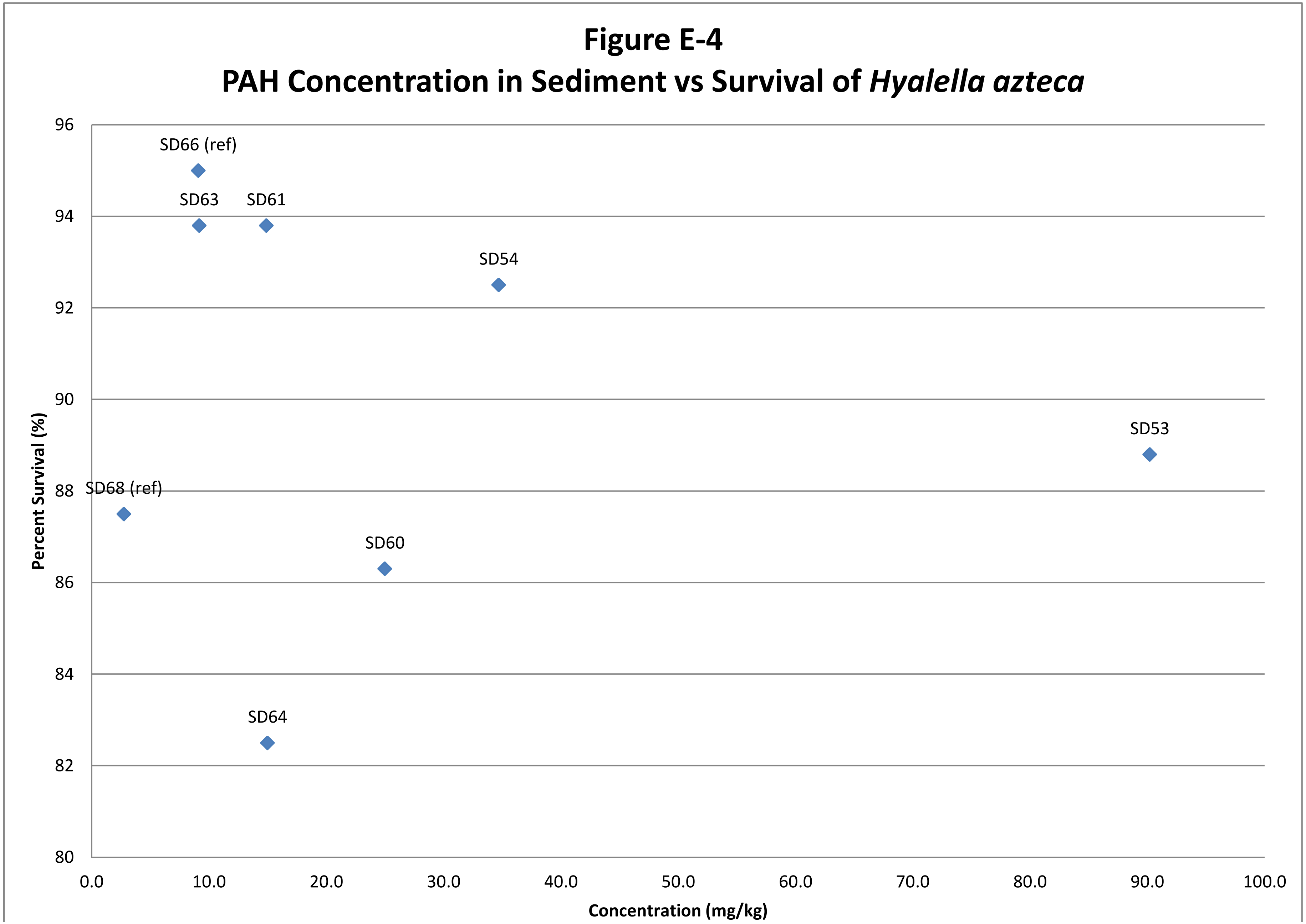


Figure E-4
PAH Concentration in Sediment vs Survival of *Hyalella azteca*
Percent Survival (%)
Concentration (mg/kg)
96
94
92
90
88
86
84
82
80
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
SD66 (ref)
SD63
SD61
SD54
SD53
SD68 (ref)
SD60
SD64

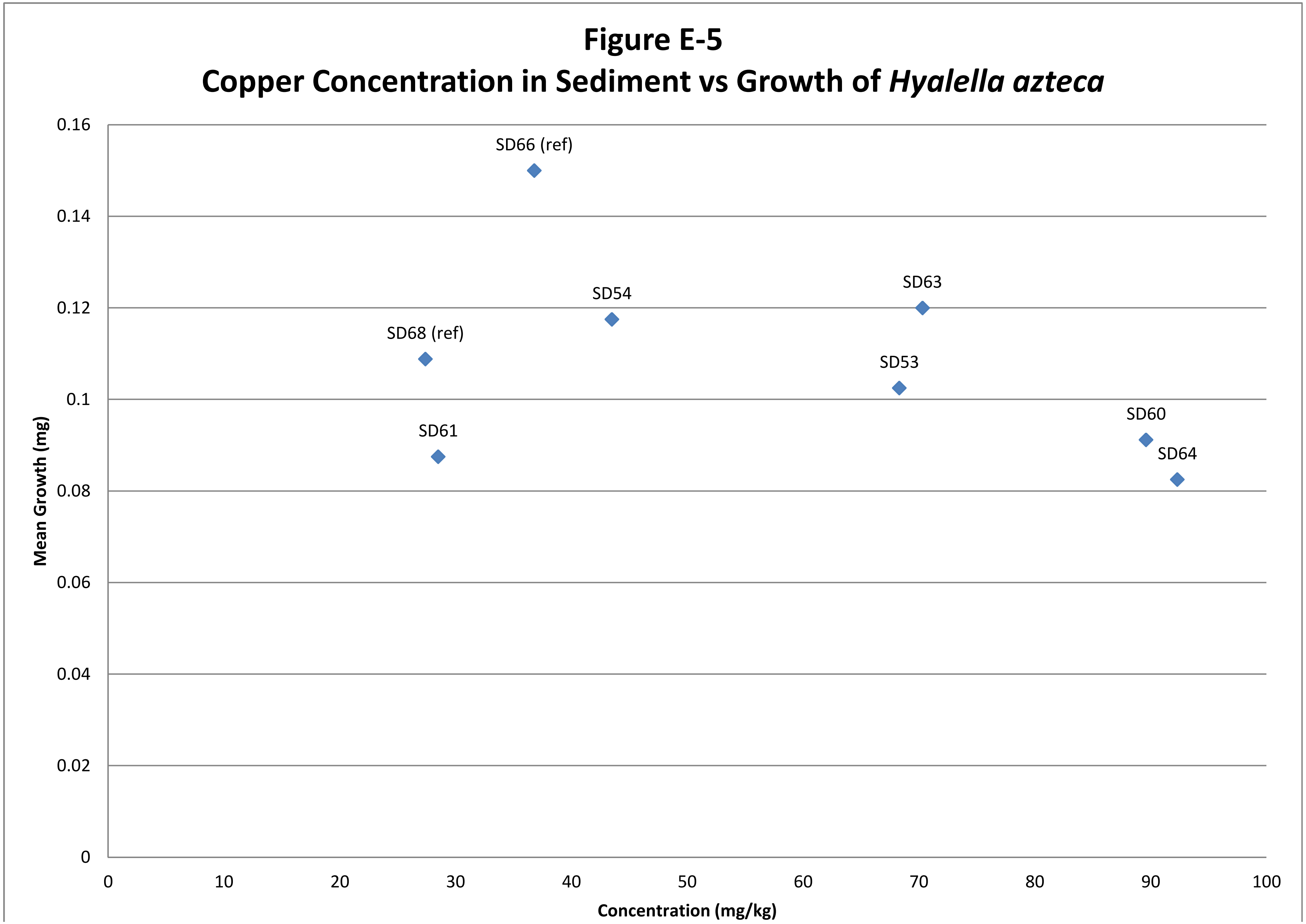


Figure E-5
Copper Concentration in Sediment vs Growth of *Hyalella azteca*
Mean Growth (mg)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SD66 (ref)
SD54
SD63
SD68 (ref)
SD53
SD60
SD61
SD64
0
10
20
30
40
50
60
70
80
90
100
Concentration (mg/kg)

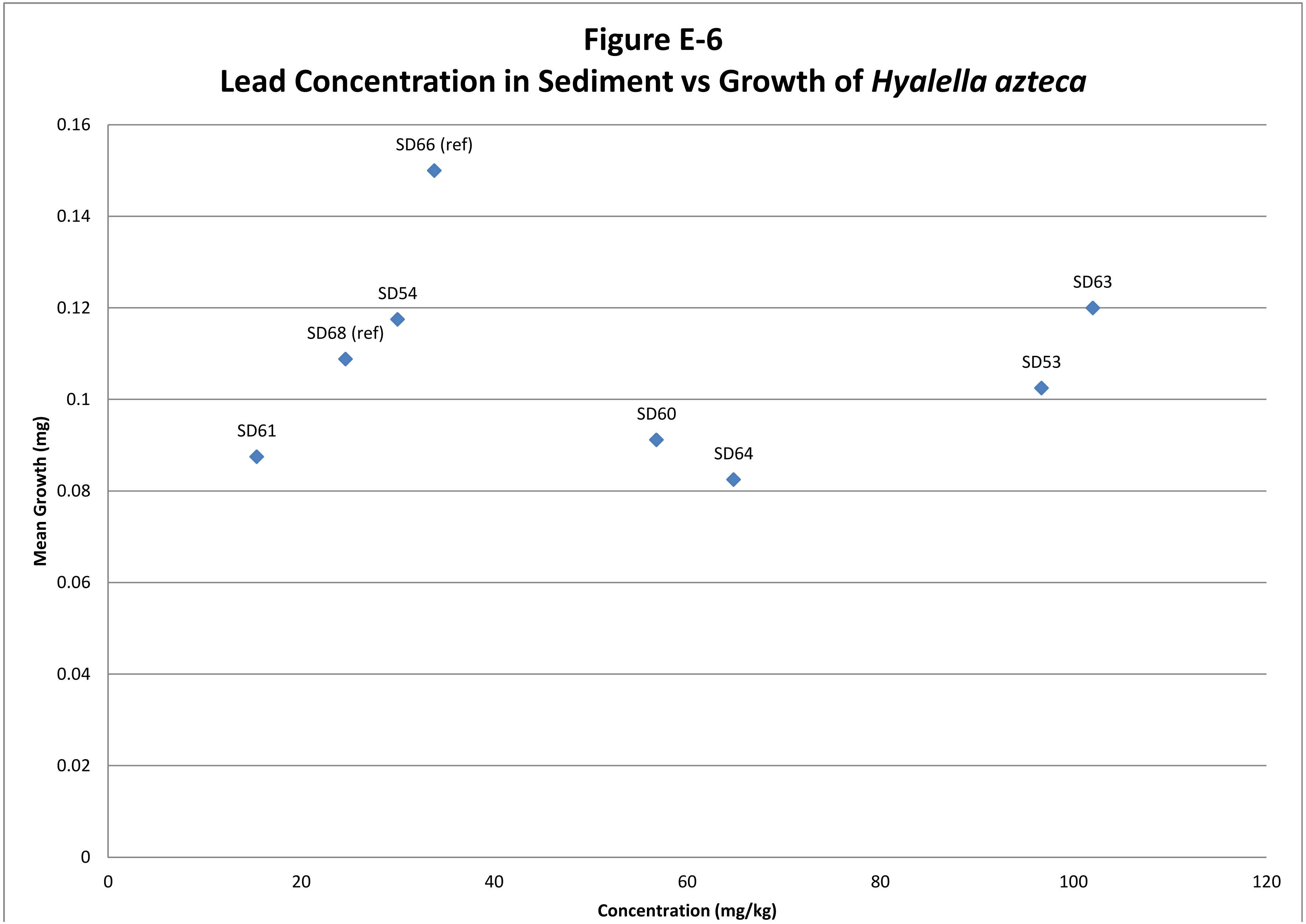


Figure E-6
Lead Concentration in Sediment vs Growth of *Hyalella azteca*
Mean Growth (mg)
Concentration (mg/kg)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
20
40
60
80
100
120
SD66 (ref)
SD54
SD68 (ref)
SD61
SD60
SD64
SD63
SD53

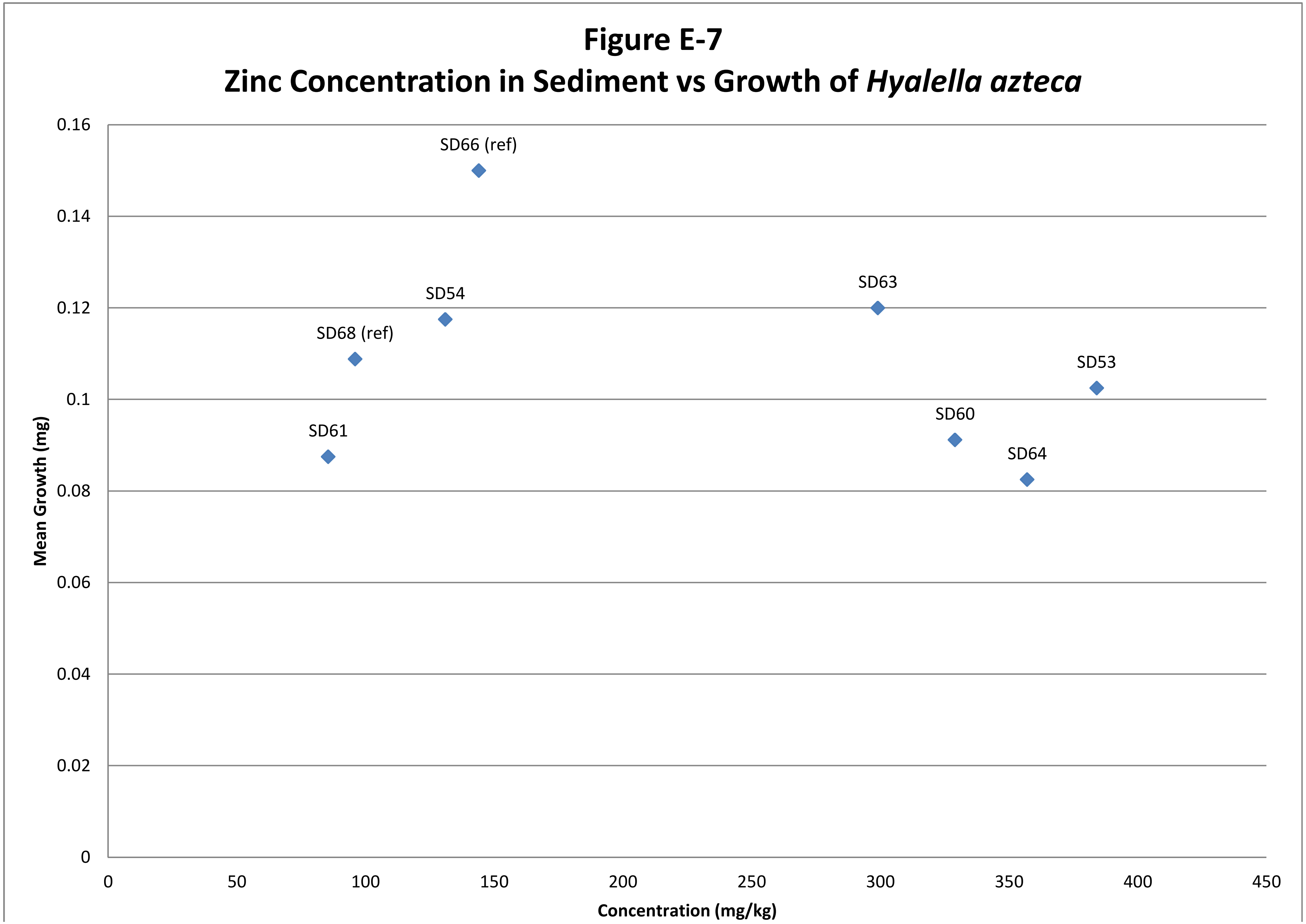


Figure E-7
Zinc Concentration in Sediment vs Growth of *Hyalella azteca*
Mean Growth (mg)
Concentration (mg/kg)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0
50
100
150
200
250
300
350
400
450
SD66 (ref)
SD54
SD68 (ref)
SD61
SD63
SD53
SD60
SD64

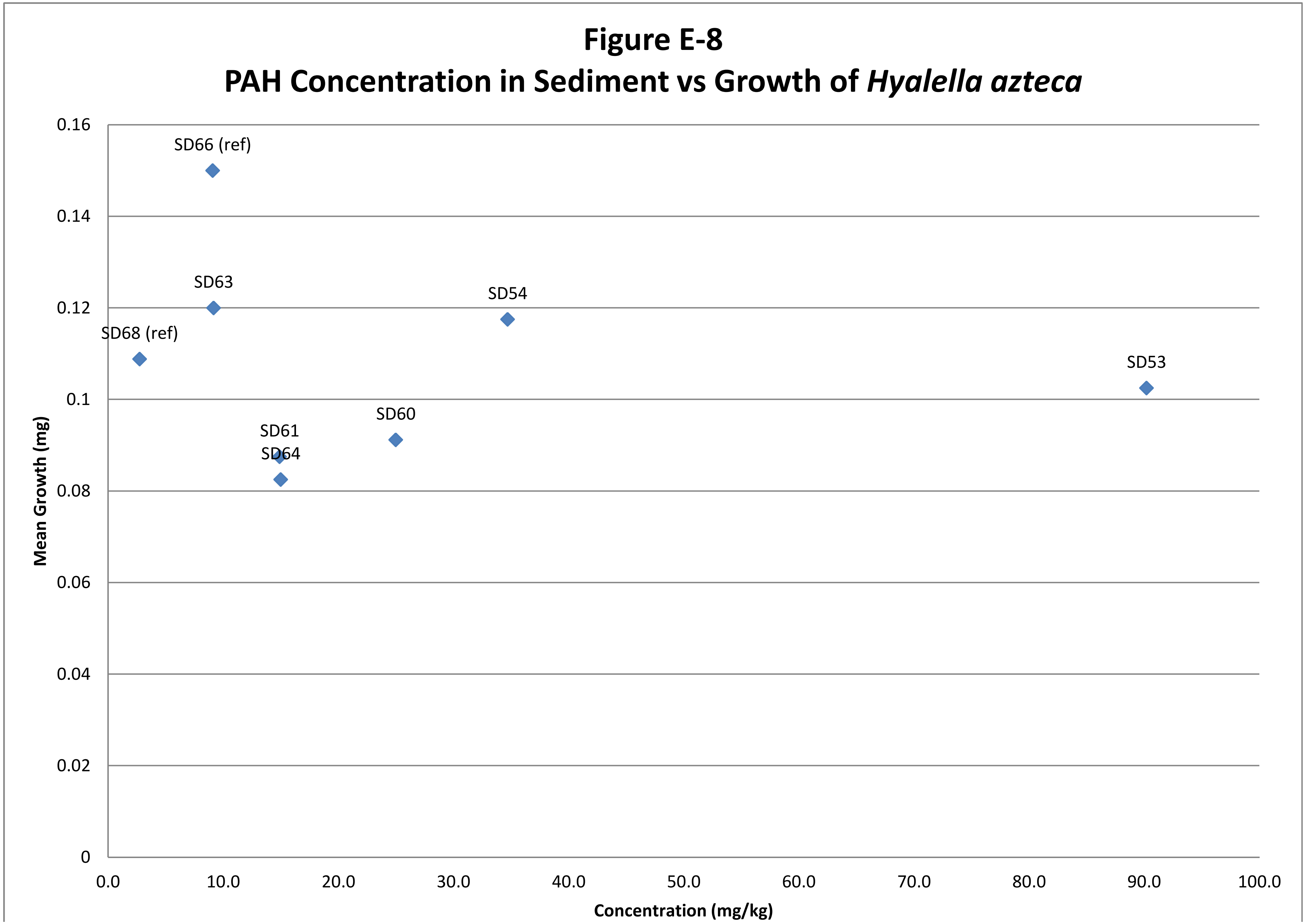


Figure E-8
PAH Concentration in Sediment vs Growth of *Hyalella azteca*
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SD66 (ref)
SD63
SD54
SD68 (ref)
SD53
SD60
SD61
SD64
Mean Growth (mg)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Concentration (mg/kg)

IL7170024577

TETRA TECH

PITT-07-12-053

July 27, 2012

Project 112G01021

Dept. of the Navy
Naval Station Great Lakes
NAVFAC MW Code EV
Attn: Benjamin Simes
201 Decatur Ave.
Building 1A
Great Lakes, IL 60088

Reference: CLEAN Contract No. N62467-04-D-0055
Contract Task Order 474

Subject: Final Reports
1. Tier II UFP Sampling and Analysis Plan for Sediment Characterization in Support of the Feasibility Study
2. Sediment Characterization Report in Support of the Feasibility Study

Site 17 – Pettibone Creek
Naval Station Great Lakes
Great Lakes, Illinois

Dear Mr. Simes:

Tetra Tech Inc. is pleased to submit three copies of each of the subject reports. Copies have also been distributed as indicated below. Please distribute the copy to Howard Hickey through your internal mail.

If you have any questions or concerns regarding these reports, please contact Aaron Bernhardt at (412) 921-8433 or me at (412) 921-7251.

Sincerely,

for Leanne Dawson

Robert F. Davis, P.E.
Project Manager

RFD/alk

Enclosure

cc: Howard Hickey, NAVFAC Midwest (1 copy)
Brian Conrath, Illinois EPA (3 copies)
Beth Whetsell, Illinois DNR (1 copy)
Owen Thompson, USEPA Region 5 (2 copies)
Glenn Wagner, Tetra Tech Administrative Record (1 copy)
Dave Barclift, NAVFAC (1 CD)
Tom Spriggs, NAVFAC LANT (1 CD)
Dawn Hayes, NAVFAC LANT (1 CD)
Aaron Bernhardt, Tetra Tech (1 CD)
John Trepanowski, Tetra Tech (letter only)
File 112G01021CTO 474, Tetra Tech (1 copy unbound)

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July 12, 2012

RESPONSE TO COMMENTS
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY COMMENTS
JUNE 27, 2012
DRAFT SEDIMENT CHARACTERIZATION REPORT IN SUPPORT OF THE FEASIBILITY STUDY FOR SITE 17 – PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

1) **Executive Summary** — The first sentence of the third paragraph concludes by stating that since the predominant source of the contamination appears to be off-site, the chemicals may not be site-related. Illinois EPA agrees that there are off-site sources, but it is misleading to state that those chemicals may not be site-related. It would be more accurate to state that much of the contamination appears to have originated off-site and therefore, not all of the identified chemical contaminants are site-related.

***Response:* The requested change will be made. The sentence will be modified to read as follows: "Previous investigations detected elevated concentrations of several chemicals in the most upstream samples in Pettibone Creek, indicating that the predominant source of these chemicals appears to be off-site of NSGL; therefore, not all of the identified chemical contamination is site related."**

2) **Executive Summary** — It is noted here and throughout the report that the suspended sediment samples have not yet been collected so the text referring to those samples is just a placeholder. It is difficult to make a determination and reach a conclusion regarding the final remedy for this site without all of the expected data. Please be sure to revise the report as soon as possible once that data becomes available. Is there a projected date for collecting those samples?

***Response:* The suspended sediment samples were collected and data will be included in the final report. Tables presenting the analytical results and comparisons to criteria along with the associated text that will be added to the report will be provided to the project team for review as soon as they are available.**

3) **Section 2.1.1** — In the fifth paragraph it states, "Ten particles were measured in each transect using calipers to determine the size class." That statement is incorrect. The reviewer observed this process first-hand and calipers were not used. Please revise this statement accordingly.

***Response:* The text will be modified as follows: "Ten particles were randomly picked from the substrate at even intervals across each transect and measured with a sand gauge. Particles were determined to be either silt, very fine sand, fine sand, medium sand, coarse sand or very coarse sand. Particles larger than coarse sand were measured on a millimeter scale."**

4) **Section 2.1.3** — The discussion regarding the sediment traps being repositioned should be expanded to include the dates of the storms and the number of days in which the traps were out of position, etc.

***Response:* The last paragraph of Section 2.1.3 will be modified as follows: "After the samplers were first deployed, a storm event caused debris to gather on the upstream side of the traps and the water pressure turned the traps vertically so they were no longer collecting sediment. The traps were found out of position on April 30th. The debris was removed and the traps were repositioned three days later on May 3rd.**

RESPONSE TO COMMENTS
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY COMMENTS
JUNE 27, 2012
DRAFT SEDIMENT CHARACTERIZATION REPORT IN SUPPORT OF THE FEASIBILITY STUDY FOR SITE 17 – PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

5) **Section 2.3** — Please provide an explanation for why the sediment samples were not analyzed for grain size as was called for in the Sampling and Analysis Plan.

Response: ***The grain size samples were not collected due to an oversight when reviewing the SAP in the field. The fourth paragraph of Section 2.3 will be modified as follows: "Physical sediment data, such as total organic carbon (TOC), and pH, were collected to help describe habitat conditions and assist in understanding the spatial distribution and magnitude of contamination. Although it was specified in the SAP, the sediment samples were inadvertently not analyzed for grain size due to an oversight during the sampling event. However, the absence of the data did not impact the results of the investigation because the pebble count conducted as part of the benthic invertebrate study was adequate to characterize the sediment substrate. The grain size data collected in 2001 during the RI are presented in Table 2-4. The sediment samples from 0 to 4 cm and from 1 foot below the sediment surface (bss) were classified as sand or silty sand. One sample was collected from 4 cm to 3 feet bss and was classified as clayey sand, which is consistent with the observation of a blue-gray clay layer located about 1 foot bss and is considered to represent native material."***

6) **Section 3.1** — It states in the last paragraph that the collected data are adequate to complete this study. Is that determination based upon only the data currently in-house or does it include the samples that are yet to be collected? Will that statement still be true if that data is not collected and included in this report?

Response: ***This statement will be reviewed and adjusted if necessary based on the Data Usability Assessment, which will be included in Appendix B of the final report. The Data Usability Assessment will evaluate the samples including the recently collected suspended sediment samples. Note that suspended sediment was collected from the sediment traps. Enough sediment was collected from NTC17PCSD50 for all analyses, but only a little sediment was collected from NTC17PCSD51 and NTC17PCSD52. Therefore, the sediment from those traps were combined and were analyzed for metals, because there was inadequate sample volume for analysis of the organic parameters. Based on a preliminary review of the results, and provided the quality of the data from the laboratory is acceptable, the data is expected to be adequate to complete the study. The suspended sediment results are just another line of evidence to determine whether there are current upstream sources of contamination to Pettibone Creek, but based on the sediment data, there do appear to be current upstream sources.***

7) **Table 3-6** — According to the footnote, the QHEI score for SD53 should be shaded as it is less than 55.

Response: ***The requested change will be made.***

8) **Figures 3-3 through 3-5** — The bars at the bottom of the figure showing the dates the samples were collected are incorrect. Please review and revise as necessary.

Response: ***The requested change will be made.***

RESPONSE TO COMMENTS
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY COMMENTS
JUNE 27, 2012
DRAFT SEDIMENT CHARACTERIZATION REPORT IN SUPPORT OF THE FEASIBILITY STUDY FOR SITE 17 – PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

9) **Section 4.1.1.2** — This section should clearly point out whether there was a measurable difference between the test site and reference site in regards to chemical concentrations.

Response: ***An additional paragraph will be included after the third paragraph in Section 4.1.1.2 to clarify chemical concentration differences between the test and reference sites. The additional text will be as follows: "Chemical concentrations in the site samples were generally greater than concentrations in reference samples. However, chemicals concentrations from the North Branch tributary (NTC17PCSD57 and NTC17PCSD58), NTC17PCSD59, NTC17PCSD62, and NTC17PCSD63 were similar to reference samples concentrations for total PAHs. Chemical concentrations from the North Branch tributary (NTC17PCSD57 and NTC17PCSD58), NTC17PCSD54, NTC17PCSD59, NTC17PCSD61, and NTC17PCSD62 were generally similar to reference samples concentrations for the primary metals of concern (copper, lead, and zinc)."***

10) **Section 4.1.1.3** — The last sentence appears to be slanting the discussion somewhat. While it may be accurate, to be fair, it should be stated whether there was a statistical difference between the mean growth in test samples versus the mean growth in reference samples also.

Response: ***The last sentence will be expanded as follows: "The toxicity testing indicated acceptable survival for the site and reference samples. Mean growth in some of the site samples was significantly lower than the mean growth in one reference sample (NTC17PCSD66). However, this reference sample had much greater growth compared to the other reference sample (NTC17PCSD68). Tables C-2 and C-3 in Appendix E show which samples had lower growth compared to the growth in sample NTC17PCSD66. None of the site samples had significantly lower mean growth compared to the mean growth in the reference sample from NTC17PCSD68. Therefore, growth is not considered impacted in site samples."***

11) **Section 4.1.1.4** — The discussion here regards the overall benthic invertebrate community evaluation. There is discussion provided that, in general, the benthic communities were better in the reference reaches than in the site reaches. The discussion of the chemicals detected in the site samples does not provide this same comparison. That comparison needs to be provided and discussed here as well.

Response: ***A sentence will be added after the sixth sentence of Section 4.1.1.4 which discusses exceedance of screening values. The following text will be added: "In general, concentrations of contaminants (primarily PAHs and metals such as copper, lead, and zinc) are generally higher in the North Branch of Pettibone Creek (site reaches) compared to the South Branch (reference reaches). However, there does not appear to be a correlation between chemical concentrations in the sediment and any of the benthic macroinvertebrate metrics, which indicates that sediment chemistry may not be the reason for the "poor" to "fair" benthic community health ratings."***

12) **Section 4.2** — The recommendation should be clear that it applies only to Pettibone Creek, not all of Site 17. The Boat Basin was not included in this investigation.

Response: ***A sentence will be added after the first sentence in Section 4.2 to state "This recommendation only applies to the portion of Site 17 evaluated in this investigation which is the North Branch of Pettibone Creek that lies within the NSGL property boundary, exclusive of the Boat Basin."***

13) **Section 4.2** — The stated recommendation is for no further action at the site. The reason provided for this determination is that the poor benthic communities found in some of the North Branch samples are likely related to habitat and not the sediment chemistry. The Agency can concur that the available habitat is a contributing factor along with the physical stressors related to stream velocities, etc., but the sediment chemistry may also contribute to the adverse effects. This should be clearly stated.

    The Agency can concur though that while certain restoration activities might help improve the biological integrity of the creek, a removal of contaminated substrates alone will not likely make a significant difference in the state of the benthic communities within the creek.

Response: ***Comment Noted. The first paragraph of Section 4.2 will be modified as follows to indicate the potential contribution of sediment chemistry to poor benthic community health: "Based on the results of this investigation, no actions are recommended for Pettibone Creek because a combination of available habitat, physical stressors related to stream velocities, and sediment chemistry may contribute to the poor benthic communities observed in some of the North Branch samples. However, removal of contaminated sediment would not likely result in a significant benthic community in Pettibone Creek for reasons discussed below because there appears to still be current sources of contamination to Pettibone Creek."***

14) **Section 4.2** — Another restoration activity that would help improve habitat in the creek is the repair or re-routing of the nearly 30 storm water outfalls that empty into the creek on base, many of which have long been in a state of disrepair.

Response: ***The Navy notes this comment. The comment will be passed onto the public works group and it will be addressed when funding becomes available. Also the following text will be added before the last sentence of Section 4.2: "Additionally, the repair or re-routing of the stormwater outfalls that empty into the creek on base would help improve habitat in the creek."***

15) **Appendix A** — Suggest adding additional photographs to better show the differing conditions encountered within a single reach and to show an example of surface sediment collection activities.

Response: ***Photos of several sampling reaches are provided in Appendix B of the Benthic Community Survey Report (Appendix B). Photos were taken facing upstream and downstream and different conditions within the same reach can be seen in some of the photos. A selection of these photos will also be included in Appendix A. No photographs of the surface sediment collection procedures were taken.***

16) **General Comment** — In the Agency's provided comments on the sampling plan in regards to the

screening levels, we stated that "A thorough review of the listed values to confirm that they remain current could not be completed in the time allotted. Therefore, the Agency reserves the right to request revisions to these values once a more complete review has been conducted." Unfortunately, insufficient time has been allotted for our review of this submittal as well. Therefore, Illinois EPA requests the Navy consult the Agency's website and the provided databases to confirm that the most up-to-date screening values have been used.

***Response*: Comment Noted. As requested by the Illinois DNR, the criteria presented in the report will be updated as follows: PAH sediment data will be compared to the baseline sediment remediation concentrations in the 2009 update of the Tiered Approach for Evaluation and Remediation of Petroleum Product Releases to Sediments. Pesticide, PCB, and metals sediment data will be compared to USEPA Region 5 Ecological Screening Levels for Sediment.**

July 12, 2012

RESPONSE TO COMMENTS
ILLINOIS DEPARTMENT OF NATURAL RESOURCES COMMENTS
JUNE 27, 2012
DRAFT SEDIMENT CHARACTERIZATION REPORT IN SUPPORT OF THE FEASIBILITY STUDY FOR SITE 17 – PETTIBONE CREEK
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

1) The Navy uses the 2000 draft sediment clean-up objectives (SCOs) to screen results. There is an updated 2009 draft and some of the values are significantly different (lower). Are the "unpublished derived water quality criteria" used to calculate some of the baseline SCOs still relevant or have they been revised also?

Response: ***The sediment criteria using unpublished derived water quality are no longer relevant. Because only PAH data is provided in the 2009 update, the criteria presented in the report will be updated as follows: PAH sediment data will be compared to the baseline sediment remediation concentrations in the 2009 update of the Tiered Approach for Evaluation and Remediation of Petroleum Product Releases to Sediments. Pesticide, PCB, and metals sediment data will be compared to USEPA Region 5 Ecological Screening Levels for Sediment.***

2) The mIBI has limited value due to the sampling occurring in March. In terms of taxa present and their abundance in the site reaches, although such data may be realistically compared to the reference reaches at that time of year, an mIBI value should not be assigned to each reach and those reaches compared unless those scores are going to be strictly assigned to an early spring sampling. The early spring mIBI scores should not be compared to summer scores generated previously.

Response: ***Comment noted. The primary comparisons of the mIBI values were between the site samples and the reference samples that were collected during the same sampling event in March 2012. The benthic report in Appendix B presented some mIBI scores in samples collected by Illinois EPA from other locations in the region during their standard index period for information purposes. No conclusions regarding the health of the benthic community in Pettibone Creek were based on this additional information though. The following statement will be added to the end of the first paragraph on page 11 of Appendix B: "No conclusions regarding the health of the benthic community in Pettibone Creek were based on this additional information."***

3) Are any of the trends of total taxa and chemical concentrations being driven by pollution-tolerant species? Please evaluate the locations where there were a greater number of taxa present with higher chemical concentrations and determine whether the taxa are more diverse due to the occurrence of more pollution-tolerant species.

Response: ***Test site NTC17PCSD63 had a high number of taxa (30) and higher than average concentrations of copper, lead, and zinc. Five of the 30 taxa (17%) were considered tolerant (tolerance values ≥ 7). In comparison, eight of 31 taxa (26%) were tolerant in reference site NTC17PCSD67, with the highest number of taxa and low concentrations of metals. High diversity does not appear to be due to tolerant taxa in this case. The tolerant taxa that were common to both samples included Oligochaeta, Tanytarsus, Cryptochironomus, and Stenelmis. Unique to the test site was Chironomus, which has the highest possible tolerance value (11).***

It appears that taxa diversity was not driven by pollution tolerant taxa. Taxa richness is typically driven by sensitive taxa, that tend to occur in lower numbers and to disappear when stresses cause unsuitable

conditions. Tolerant taxa are sometimes present in low numbers even when environmental conditions are relatively good and they increase in numbers as conditions worsen. Changes in abundance may have no effect on richness. Using the same samples discussed above, two taxa in the test sample were intolerant of pollution (tolerance values ≤3) as were three taxa in the reference sample.

The paragraphs above will be added to Appendix B in Section 3.2 before the first full paragraph on page 8 and to the main text of the report in Section 3.1.1 immediately before the paragraph beginning within "Taxa in the sensitive insect orders...".

4) Some of the tables include MacDonald et al. 2000 Threshold Effect Concentrations (TEC). Please include these values in the text in addition to the PECs.

<u>Response</u>: The Region V Ecological Screening Levels for the metals are the based on the TECs. A discussion will be added to Section 3.1.2.1 to indicate this.

5) QHEI scores are based heavily on professional judgment. If much weight is being given to the arguments related to the "poor or fair" benthic community sources being due to lack of habitat rather than chemical impacts, then a neutral party should perform a QHEI for comparison.

<u>Response</u>: It is recognized that the QHEI is based heavily on professional judgment, but the same person determined the scores within all of the reaches so the results should be consistent, relative to each other. The precision of the QHEI was tested during its development, by making comparisons between observations on different dates by the same observer and between observations by different observers on the same date (Rankin 1989). A paired t-test showed no significant difference (p>0.05) in the final QHEI scores or in 4 or more of the 6 individual metric scores, depending on the comparison. The scoring difference averaged less than one point for each of the variables. Therefore, it is unlikely that an independent evaluation of the QHEI scores would be much different than what was found, so it is not considered necessary. The following paragraphs describe the other lines of evidence used to determine whether chemicals in sediment were responsible for the benthic community in the creek to show that the majority of the weight was not based on the QHEI scores.

Because almost 50% of the variability in the biological index can be attributed to the QHEI, habitat is an important line of evidence which suggests that non-chemical factors are likely responsible for at least some of the benthic community results. The habitat variables that had the greatest difference in average magnitude between (non-tributary) reference and test sites were instream cover and channel morphology. Channel morphology also had the greatest variability (highest standard deviation) among the reference site scores. This is not to suggest that the QHEI or any of the component variables are imprecise, but that the channel morphology may actually be variable within reference sites. The Navy maintains that there is a habitat effect on biological conditions, as illustrated in Figure 8 in Appendix B of the report. The Navy also assumes that the variability in measurement of any one data point applies equally to all data points, and that even with potential imprecision, the habitat effects on biology are real.

Note that the QHEI was only one of several lines of evidence used to determine whether the "poor to fair" benthic community was caused by chemicals in the sediment. Another line of evidence was the plots of several benthic community metrics such as mIBI, total Taxa, EPT percent score, and density versus chemical concentrations in the sediment. These plots did not indicate that chemical concentrations were correlated with the various benthic metrics. Finally, another line of evidence that was used to evaluate impacts to the benthic community was the toxicity tests. These tests are typically used to directly link

chemical concentrations to impacts to benthic invertebrates because the chemical concentrations in the sediment that is used for toxicity testing are known. The fact that none of the site samples were considered toxic, provide the best evidence that the chemical concentrations in the sediment are not likely responsible for the "poor to fair" benthic community in the North Branch of Pettibone Creek.

Rankin, E. 1989. The Qualitative Habitat Evaluation Index (QHEI): rationale, methods, application. Ohio EPA Division of Surface Water. Accessed 7/10/2012: http://www.epa.ohio.gov/portals/35/documents/BioCrit88_QHEIIntro.pdf

6) **Section 3.1.2, page 3-5, 4th full paragraph, last sentence.** Please specify what is meant by "typical spraying activities." Are those labeled application rates or typical activities for the Navy or the surrounding communities?

Response: The phrase was meant to indicate that the pesticide concentrations observed in the sediment are not indicative of a CERCLA release, but are representative of levels that are commonly found in areas where pesticides were applied under typical/normal conditions, regardless of whether the area is Navy property or the surrounding community. This can be seen from Table 3-2 that concentrations of the pesticides referred to in the text were similar in the site, reference, and upstream samples. The text will be modified as follows: "…typical spraying activities and not an intentional or accidental release of pesticides to the creek."

7) **Section 4.1.1.4, page 4-3, eighth sentence.** It may, in fact, be unlikely that the chemicals are the sole factor inhibiting the stream benthics; however, it is also unlikely the chemicals in the sediment are not impacting the benthic community in Pettibone Creek at all, as is indicated in this sentence.

Response: The sentence will be modified as follows: "Based on the results of these three lines of evidence, the possibility that chemicals in the sediment are at least partially impacting the benthic community in Pettibone Creek cannot be ruled out. However, the lack of toxicity observed…"

8) **Section 4.1.2.1, page 4-4, first paragraph.** Please specify the source of the mentioned pesticides, i.e. whether they are traveling from upstream or from run-off from the bluffs on base or both.

Response: Based on the low concentrations of the pesticides, and the relatively consistent results within Pettibone Creek, it is difficult to determine the source of the pesticides. Once the suspended sediment results are reviewed, it can be determined whether pesticides are entering the creek from upstream sources. Other potential sources are runoff from the facility from areas where spraying did occur, which then enters the stormwater system and discharges to Pettibone Creek through the outfalls. The following paragraph will be added to the end of Section 4.1.2.1: "Based on the low concentrations of the pesticides, and the relatively consistent results within Pettibone Creek, it is difficult to determine the source of the pesticides. Potential sources include runoff from areas where pesticides were applies to the ground, which then entered the

stormwater system and discharged to Pettibone Creek through the outfalls."

9) **Appendix B, Section 1—** In response to the statement: "No federally listed endangered or threatened species are known to exist in the area." — The Navy continues to ignore the IDNR recommendation to include the mudpuppy as a possible species of concern in Pettibone Creek.

***Response**: The statement in Appendix B, Section 1 and Section 1.3 of the main report will be modified as follows: "No federally listed endangered or threatened species are known to exist in the area. The Mudpuppy salamander is listed as a threatened species that is protected by the State of Illinois. NSGL is conducting a study to determine whether the Mudpuppy salamander is present in Pettibone Creek and the Harbor at NSGL, along with some additional locations. One sampling event was conducted in July 2011, but no Mudpuppy salamanders were observed or captured in the area during this event. Two additional sampling events occurred in 2012 but the results are not yet available."*

10) **Appendix B, Section 3.2 —** On page 7, paragraph 2, for consistency and accuracy, please change the term "stressed sites" to "test sites."

***Response**: The requested change will be made.*

11) **Appendix B, Section 3.2 —** On page 7, paragraph 3, please clarify whether any of the seven midge taxa (that occurred only in the reference sites) were considered tolerant.

***Response**: The paragraph will be modified as follows: "Taxa with high tolerance values (TV ≥ 7) are considered tolerant of pollution. Seven midge taxa occurred only in reference sites, including Ablabesmyia (TV=6), Dicrotendipes (TV=8), Micropsectra (TV=4), Nanocladius (TV=3), Parachironomus (TV=8), Paraphaenocladius (TV=6), and Rheocricotopus (TV=6). Two tolerant midge taxa were only found in test sites, including Chironomus (TV=11) and Zavrelimyia (TV=8)." This text will also be added to the main text of the report in Section 3.1.1 after the paragraph beginning with "The score of each of the metrics...".*

12) **Appendix B, Section 4, page 18 —** According to results there is 48% correlation between variability in test sites versus reference sites in regards to benthic samples and the physical habitat. The remaining 52% can be explained by other parameters (ex. Sediment chemistry and others). This provides an indication that the removal of contaminated substrate may still need to be considered.

***Response**: The Navy does not agree that because the remaining 52% of the variability in test sites versus reference sites in regards to benthic samples is related to other parameters, there is a need to remove contaminated sediment. Even if the contaminated sediment was removed, and assuming that the contaminated sediment is entirely responsible for the 52% of the variability*

(which is unlikely), then the benthic community would still be impacted by the poor habitat. Also, as discussed in other responses, the toxicity test results provide more weight that the sediment chemistry is not likely impacting the benthic invertebrates.

13) **Appendix B, Section 4, page 18** — To further enhance the physical in-stream habitat available to benthic organisms, the Navy could stop removing the wood debris (as recommended). An important additional step to consider for such action is securing the debris in the appropriate locations so scour does not occur in unwanted locations.

***Response*: Comment noted. However, although securing debris to prevent scouring is a good idea to improve the overall habitat in the stream, this is not a CERCLA issue. Therefore, the Navy cannot commit to securing the debris in this document.**

14) **Appendix B, Section 4, page 18** — In response to the following statement; "This end-of-pipe environment is a harsh habitat that would be impractical to restore to natural conditions and restoration to morphologically stable stream conditions may not benefit the biological community." — If "natural conditions" refers to pristine conditions, IDNR agrees that restoring to pristine conditions is not practical. However, restoration may be warranted to increase the biological habitat which is potentially being negatively impacted by substrate contaminants.

***Response*: The Navy agrees that restoration of the creek would be beneficial to the benthic community. However, because the harsh habitat in the creek is not caused by a CERCLA release, any restoration activities would need to be conducted under a different program.**

15) **Appendix B, Section 4, page 19** — IDNR agrees that a potential goal on which the Navy could focus for the North Branch of the creek may be to restore the physical and sediment chemistry conditions to conditions similar to the South Branch, which are attainable conditions for the region. In order to achieve such restoration, relevant mIBI values must be compared. (See previous comment on the main report.)

***Response*: Although the Navy would obviously prefer that the physical and sediment chemistry conditions in the North Branch be similar to that in the South Branch, a removal action by the Navy is not warranted at this time for several reasons. First, the physical condition of the creek is the result of natural conditions, and not the result of a CERCLA release. Also, as indicated in the main body of the report, there is still a continuing source of contamination to the creek. Therefore, even if the contaminated sediment were removed, it would likely become recontaminated from the upstream sources. No change to the text is required.**

16) It is stated on page 3 of Appendix E that "Avoidance of the sediment by test organisms was observed in some test containers, particularly sites NTC17PCSD60 and NTCI7PCSD64." Is this behavior common for test organisms in toxicity tests that otherwise show non-toxic results? Please provide an explanation

for this apparent anomaly.

Response: ***The avoidance of sediment by Hyalella azteca has been shown to be common in sediments with a very high sand content or in tests that are not fed (Ingersoll et al., 2000). The organisms were fed daily during the tests, so that would not be the reason. Although grain size analysis was not conducted, if a grain size analysis was conducted, Table 8 in Appendix B presents the percent particle size distribution for each sampling station determined by systematic random,100-particle modified Wolman pebble count. Based on the results in the table, the grain size distribution at sites NTC17PCSD60 and NTC17PCSD64 were not remarkably different that the other sites, except that the percent of silt/clay was on the lower side.***

Also, Whiteman et al. (1996) found that the 10-d LC50 for ammonia in sediment exposures with H. azteca was not reached until pore-water concentrations were nearly tenfold the water-only LB50 (at which time the ammonia concentration in the overlying water was equal to the water-only LC50). The authors attributed this discrepancy to avoidance of the sediment by H. Azteca. As seen in Appendix E, the maximum ammonia concentrations in the samples from NTC17PCSD60 and NTC17PCSD64 were elevated compared to the other stations, which may have been partially responsible for the avoidance of the sediment.

These two paragraphs above will be added to Appendix E after the first paragraph under Comments Concerning Test.

Table 3-5 in the main body of the report presents the sediment chemistry results for the samples selected for toxicity testing. As can be seen from the table, the chemical concentrations in the samples from NTC17PCSD60 and NTC17PCSD64 were lower than or similar to the concentrations in the other samples. A few chemicals had their maximum detected concentrations in those samples, but the maximum detected concentrations were not much greater than the concentrations in some other samples.

In summary, there are a few reasons why the avoidance behavior may have occurred, but none of the reasons are definitive. Therefore, an explanation for the apparent anomaly would just be speculation.

Ingersoll CG, Ivey CD, Brunson EL, Hardesty DK, and Kemble, NE. 2000. Evaluation of Toxicity: Whole Sediment Versus Overlying-Water Exposures with Amphipod Hyalella azteca. Environ. Toxicol. Chem 19: 2906-2910.

Whiteman FW, Ankley GT, Dahl MD, Rau DM, and Balcer MD. 1996. Evaluation of interstitial water as a route of exposure to ammonia in sediment tests with macroinvertebrates. Environ. Toxicol. Chem 15: 794-801.